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DEPARTMENT OF THE INTERIOR

UNITED STATES GEOLOGICAL SURVEY

WASHINGTON, D. C., JULY 3 1886

To ....

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Sir:

I have the honor to send to your address a copy of Monograph IX:

BRACHIOPODA AND LAMELLIBRANCHIATA OF THE RARITAN CLAYS, ETC.:

BY ROBERT P. WHITFIELD.

As this volume cannot be transmitted by mail, it is sent through the Smithsonian Institution's international exchange. It will not reach you, therefore, for some time after the reception of this letter.

Please fill out the inclosed receipt and return it, post paid, to the Director of the U. S. Geological Survey, Washington, D. C.

By order of the Director:

Yours, respectfully,

James C. Pilling

Chief Clerk.

DEPARTMENT OF THE INTERIOR

MONOGRAPHS

OF THE

UNITED STATES GEOLOGICAL SURVEY

VOLUME IX

WASHINGTON
GOVERNMENT PRINTING OFFICE
1885

UNITED STATES GEOLOGICAL SURVEY
J. W. POWELL DIRECTOR

BRACHIOPODA AND LAMELLIBRANCHIATA

OF THE

RARITAN CLAYS AND GREENSAND MARLS

OF

NEW JERSEY

BY

ROBERT P. WHITFIELD

WASHINGTON
GOVERNMENT PRINTING OFFICE
1885

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* In pocket at end of volume.

LETTER OF TRANSMITTAL.

GEOLOGICAL SURVEY OF NEW JERSEY,
New Brunswick, N. J., April 15, 1884.

SIR: I have the honor herewith to transfer to you the text and drawings of the Fossil Brachiopoda and Lamellibranchiata of the Raritan Clays and Greensand Marls of New Jersey. They have been prepared by Prof. Robert P. Whitfield for the Geological Survey of that State. While the fossils here described have come from a limited district of the United States, it is a district which drew the attention of paleontologists earlier, and has been studied longer, than any other, so that it is classic and typical ground for all American geologists. As such we esteem it worthy of a place among the Monographs of the United States Geological Survey, and with high appreciation leave it in your charge for publication and general distribution.

I also here append a

SKETCH OF THE GEOLOGY OF THE CRETACEOUS AND TERTIARY FORMATIONS OF NEW JERSEY.

The invertebrate fossils described in this and the succeeding volumes have been found in the geological formations which make up the southern half of New Jersey. The northwestern boundary of these formations may be traced by a line drawn in a southwesterly direction from Staten Island Sound, on the eastern border of the State, to the Delaware River at the mouth of Assanpink Creek, in Trenton, on the western side. The other boundaries are the Atlantic Ocean and Delaware Bay and River. The boundaries, except the first, need no more specific description. The northwestern boundary can be traced with a good deal of accuracy from the

Sound, about four miles northeast of Woodbridge, through the northern part of that village, and then across the hills to Metuchen, and onwards to the Raritan, which it crosses in the southern part of the city of New Brunswick, and thence onward to Ten-Mile Run and Kingston, and thence along the valley in which the Delaware and Raritan Canal runs on the south of Princeton and Trenton to the Delaware River.

The outcropping edge of these formations is thin, so that in many places the underlying red sandstone is exposed in the inequalities of the surface, or is easily reached in digging. This, of course, must leave the edge somewhat irregular, and in one place in Middlesex County, north of the Raritan, the red sandstone rises in a considerable hill south of this line, and is entirely surrounded by the white clays of this later formation.

The Raritan clay beds, with their intermediate beds of sand, which are the lowest in the series here described, are retained as a part of the Cretaceous series. Stratigraphical relations warrant this. The very few fossil shells which have been found in them are of estuary forms, and are thought by some paleontologists to bear a close resemblance to those of the Wealden or Jurassic age. The greensand and in-

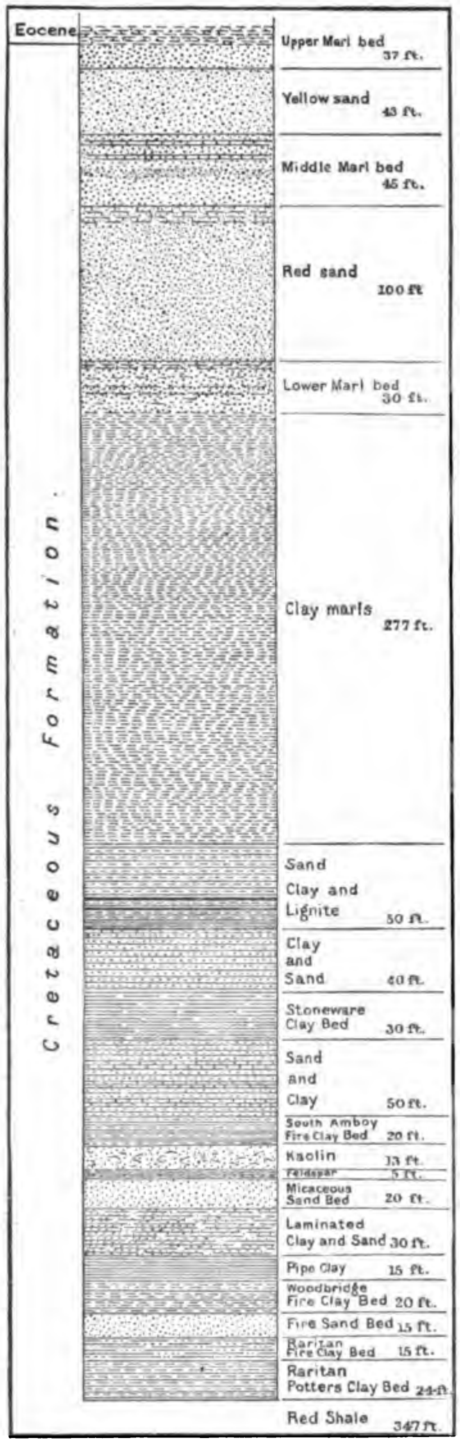

FIG. 1.—Columnar section of the Cretaceous strata of Eastern New Jersey.

termediate beds which lie immediately over these, and as far as seen, with the same general dip, though a little smaller in amount, are rich in marine fossils which are unquestionably of the Cretaceous period.

The numerous beds and strata of the series all dip gently to the southeast, the descent being not more than 50 feet per mile; while the underlying red sandstone dips towards the northwest at an angle of 10° or 12°.

The accompanying *section*, Fig. 1, across the Cretaceous and Eocene strata in Middlesex and Monmouth Counties, in which part of the State they are best exposed, will sufficiently illustrate their mode of occurrence.

The *columnar section*, Fig. 2, will further show the thickness of the Cretaceous and Eocene strata, as far as present demonstrations extend; and the *map* of the part of New Jersey in which these strata are found will make plain the numerous references to localities, which are given in the descriptions of species. In addition to the outcrop as given on the map, and the dip as shown in the section, the correctness of the columnar section has been proved by the borings in several artesian wells in which the successive strata of greensand, clay, etc., have been met in the order here laid down. The Miocene is found, with its characteristic fossils, in several isolated localities in the counties of Cumberland and Salem, but no structural or other well-marked geological peculiarities of these beds have yet been developed.

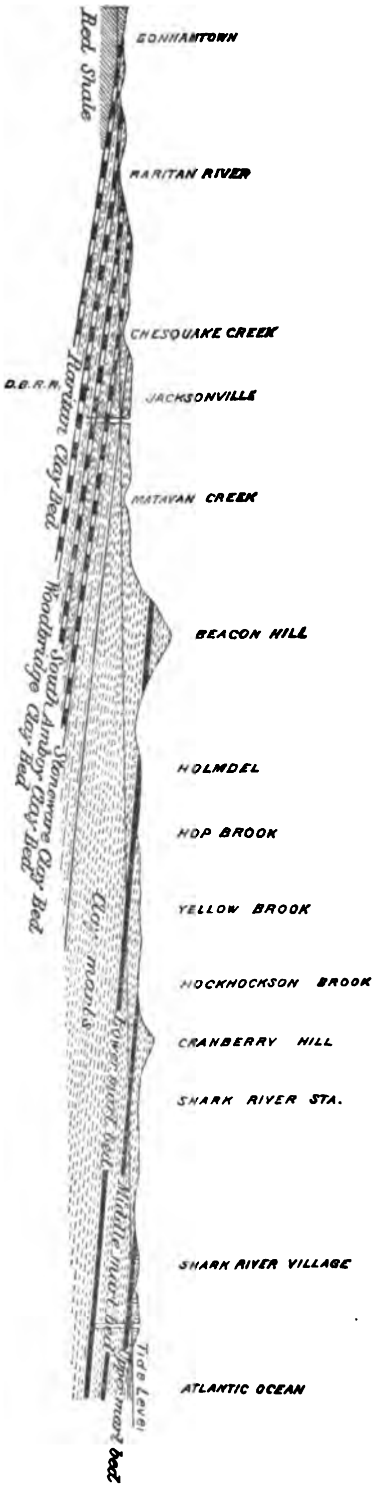

Fig. 2.—Geological section 30 miles across the Cretaceous strata of Eastern New Jersey (looking northeast).

The greater part of the State south of the Cretaceous and Eocene strata is without fossils by which to determine its geological age. It is, however, later than the Miocene, as is to be seen where they meet, and it is older than the Glacial, as is shown where the glacial drift overlies the same formation in some of the country immediately north of the Raritan. It appears to be regularly stratified, though all the strata are earthy, no rock having been met in boring into it. Regular and extended beds of clay and sand have been found in the various places which have been bored into, but no fossils have been met with. In this state of our knowledge, it is safe to call these beds representatives of the Pliocene age.

The tide marshes, the sand beaches, and some low lying upland on the borders of the sea and bay sides, are of the Quaternary period, and furnish a few fossils which scarcely differ from the living species now found in the adjacent tide waters.

From the foregoing sketch of the geology of Southern New Jersey, it will be seen that by far the greater number of fossils described in this work are from the greensand beds of the Cretaceous formation. Fossils are really much more abundant in these beds than in any of the others, and, besides, these beds have been opened more extensively than any others on account of the value of the marls which compose them, and which are used for fertilizing the soil.

Some of the species are very abundant, while of many others only single specimens have been found, and very many of these forms have only been found as imperfect casts.

There is no complete collection of these fossils, and the Geological Survey of New Jersey possesses only a small part of them; for the remainder specimens have been borrowed wherever they could be got, and their ownership is given in the printed descriptions.

The fossils in the New Jersey marls attracted the attention of naturalists at a very early day; Dr. S. G. Morton and Prof. L. Vanuxem, of Philadelphia, described some of them in the sixth volume of the Journal of the Academy of Natural Sciences in 1828–'29, and in the seventeenth volume of the American Journal of Science in 1830, and since that time many additions have been made to the number described by others, whose names will appear in their proper places. This work of Professor Whitfield, in bringing the fossils together and in revising and correcting imperfect descriptions, and in making new and better drawings of the fossils, will be appreciated by every paleontologist; and the new species he has been able to add give completeness to the subject, and it is hoped will make the book a useful and standard one both for the student and the field geologist. Heretofore, many of these fossils which were described were not figured, and the descriptions were scattered in so many different works that they were practically inaccessible to most persons, and especially to those who by their residence on the formations were most competent to make collections. It is a publication which has long been looked for by citizens interested in geology, and it is fair to anticipate from its use much benefit to the scientific geology of the region from which its materials are drawn.

As the collected work of the pioneers in paleontological study on this continent, it becomes of permanent interest to geologists both for the persons whose labors it perpetuates and the localities which they explored.

I am, with high respect, your obedient servant,

GEO. H. COOK,
State Geologist of New Jersey.

Maj. J. W. POWELL,
Director U. S. Geological Survey.

LETTER OF TRANSMITTAL.

NEW YORK, *March* 31, 1884.

DEAR SIR: I herewith transmit to you the following descriptions and illustrations of the *Brachiopoda* and *Lamellibranchiata* of the Green Marls and accompanying Clays of New Jersey, which form a part only of the paleontological report on the fossil remains of the State.

In presenting the report allow me to express my sincere thanks for the many kindnesses which I have received at the hands of yourself and your assistant, Professor Smock, in obtaining material for the work. I am also greatly indebted to the officers of the Academy of Natural Sciences at Philadelphia, Pennsylvania. I have been obliged to borrow largely from their collection, as it contains very many of the types of Mr. T. A. Conrad and Mr. W. M. Gabb, as well as of Dr. S. G. Morton, and those of Mr. Isaac Lea's species of *Unionidæ*. I am, however, under special obligation in this respect to Profs. A. Heilprin and H. Carville Lewis. I have also had the loan of specimens from Columbia College, N. Y., through Dr. J. S. Newberry, and from Dr. Lawrence Johnson and Miss F. M. Hitchcock, of New York, to all of whom I wish to express my thanks. I have also availed myself largely of specimens from the cabinet at Rutgers College under your charge, and from the cabinet of the American Museum of Natural History in New York City.

Yours, very truly,

R. P. WHITFIELD.

Prof. GEORGE H. COOK,
State Geologist of New Jersey.

PRELIMINARY REMARKS.

In offering the following report on a portion of the organic remains of New Jersey, I would state that the very imperfect material with which I have had to deal, as well as the small number of related specimens, often having only a single imperfect individual of a species, and that one the original type, must form my excuse for the great imperfection of description and meagreness of illustration.

The report contains all the species of *Brachiopoda* and *Lamellibranchiata* of the greensand marls and their accompanying clays of the State, so far as I am able to learn, hitherto described and published, as well as several now made known for the first time. The published species have not before been brought together in any form, even in a catalogue; and the descriptions have been given in so many different publications, and through such various channels, that it has been very difficult to ascertain when they had all been collected. I am by no means certain, even now, that I may not have overlooked some isolated paper or obscure pamphlet containing descriptions or mention, but every means has been employed to make the search as thorough as possible, and every known trace of publication or reference to papers has been followed to its source.

Another difficulty with which I have had to contend has been the want of material. This has been an almost insurmountable obstacle to rapid and systematic work, as there are no comparatively complete collections of the marl fossils in existence at any one place. This arises principally, I presume, from the fact that marl fossils are very difficult to preserve for any length of time, owing to their rapid disintegration from the effects of finely disseminated pyrite in the marls, which, on exposure to the air, rapidly destroys them, thereby discouraging persons from collecting. This, however, might in a measure be remedied by judiciously cleaning the specimens from unnecessary sand and marl when first taken from the pits, and after thorough drying, soaking the specimens in boiling glue, of a consistency sufficient readily to penetrate the marl, which, on rapidly drying again, will be hardened and protected so as to be preserved for an indefinite period. Specimens which I treated in this manner twenty-six years ago are as perfect to-day as when first prepared.

It will be noticed that by far the larger part of the species here described are from the Lower Marl Beds. Leaving out the *Brachiopods*, of which there are only five given, including one doubtfully from within the State, there are two hundred and thirty species and varieties. Of these, five are from the clays below the Lower Marl Bed; eleven, including *Gryphœa vesicularis*, which occurs most abundantly in the Lower Marl Bed, are from the Middle Marl Bed; seventeen are from the Cretaceous layers at the base of the Upper Marl Bed; twenty-three are from the Eocene layers at the top of the Upper Marl Bed; and twelve species of *Unionidœ* are from the clays at Fish House. This leaves one hundred and sixty-three species for the Lower Marl Bed, only one of which is known to occur in any of the other beds; *Gryphœa vesicularis* being common to the Lower and the Middle Beds, and also recognized in a single individual in the Eocene layers. *Idonearca vulgaris* was supposed to pass from the Lower to the Middle Bed, but I find that the Middle Marl Bed specimens belong to quite a distinct form. *Ostrea* or *Gryphœa Bryani* Gabb, in one of its varieties, appears to be common to the Middle Bed and to the lower layers of the Upper Bed. Beyond these I have no evidence of a passage of species from one bed to any of the others. There is, however, some difficulty in satisfactorily determining whether this is really the case, as most of the collections which I have examined are not carefully labeled with locality or position, and from their great similarity of material they present a peculiar liability to error. This may be said to be particularly the case with the collections deposited in the Academy of Natural Sciences in Philadelphia, many of which have no other record of locality or position, either with the specimen or embodied in the description of the species of which they are the types, than simply that of "Cret. N. J." Others mention only the county in which they were found. This condition I find in other collections as well, and it is likely to have been a fruitful source of error. The blame, however, in the case of the Academy of Natural Sciences rests solely with the original collectors and authors of the species; and if some of these errors are continued in the present work from these causes, I do not feel that they could have been avoided. The collections at the Academy of Natural Sciences are, nevertheless, extremely valuable, as they are largely types of species by Conrad, Gabb, and Morton. Of the latter, however, there are very few remaining.

It will be noticed that very few of the species have been recognized from localities outside of the State It is certainly peculiar that so many local species should have existed within the limits of New Jersey. This may, however, be attributed to certain causes which have existed over these areas during the deposition of these formations, and which would have produced a special fauna fitted for those conditions by eliminating from it all other forms not fitted to withstand them. Beyond this, certain rapid or sudden changes seem to have taken place over nearly the entire coast of this State, at somewhat regular periods, which materially changed the conditions of life abruptly. These are recorded in the changes from the greensand deposit to a siliceous sand deposit between the several layers of marls, in which no animal remains occur. These abrupt changes in conditions and extinction of life over these areas at times also account for the almost entire change of species in the different beds of marl. But there is still another reason, and perhaps a more direct one, why so few of the species have been identified from other localities than those of the greensand region. This is the condition of preservation of these marl fossils, which are generally only seen as internal casts, and therefore very difficult to identify with perfect shells. But even among the few which have heretofore been cited as common to New Jersey and more southern localities, I find few that will bear critical comparison. For this reason I have been compelled to change the names of several of the species where the types were from those southern localities.

In regard to the identity of the New Jersey beds with the supposed equivalent beds of other parts of the country, I am not prepared at present to give a very decided opinion. I see no reason, however, to dispute the notion generally held that the Lower Marl Bed of the State is equivalent to No. 4, or the Fort Pierré group of the Upper Missouri Cretaceous region. In regard to the Raritan Clays which underlie the Lower Marl Bed, I have made some suggestions preceding their description. And in regard to the beds at the top of the Upper Marl Bed, referred to as Eocene, I would state that so far as the *Lamellibranchiate* shells are concerned, there is so little in common with the Eocene known from other localities, that, taken alone, their evidence is not very strong either for or against this Eocene age. The *Gasteropodous* fauna, however, is more Eocene in its character than that of the *Lamellibranchiates.*

BRACHIOPODA AND LAMELLIBRANCHIATA

OF THE

RARITAN CLAYS AND GREENSAND MARLS OF NEW JERSEY.

By R. P. WHITFIELD.

BRACHIOPODA.

SECTION I.

BRACHIOPODA FROM THE SEVERAL MARL BEDS OF THE STATE.

DESCRIPTION OF SPECIES.

The fossil Brachiopoda are not very well represented in the Cretaceous formations of America, and the New Jersey beds form no exception to this rule. In Europe, as a general thing, this class of shells is quite abundant, and although the genera are not as numerous as they are in Paleozoic formations, yet the species are many. But in America there are few species, and those mostly confined to four genera, namely, *Terebratula*, *Terebratulina*, *Terebratella*, and *Rhynchonella*. In New Jersey, so far as at present known, only three of these genera are represented; the last one, *Rhynchonella*, being entirely absent. In regard to individuals, two of the species known to occur within the State may be said to be abundant, *Terebratula Harlani* and *Terebratella plicata*. The latter is moderately abundant as scattered individuals in the Gryphæa beds of the lower marls, but has never yet been found in large quantities; while the former, *T. Harlani*, occurs in vast numbers, forming, at several localities, beds of several feet in thickness, made up almost entirely of the broken and often water-worn valves of this species, with a very moderate number of entire individuals The conditions of life prevailing in the New Jersey seas during the formation of the green marls do not appear to have been favorable to the existence of this form of *Molluscoid*, but in a few localities the vast abundance of *Gryphœa vesicularis* which had accumulated just below, and whose shells had formed beds of several feet in thickness, appear to have furnished, by their maceration and solution, a sufficient amount of calcareous material to have afforded the proper conditions requisite for these shells, and for vast numbers of foraminiferous bodies as well; as the so-called calcareous sands associated with the *Terebratula* and *Gryphœa* is composed almost entirely of the remains of these minute organisms. Of the species of *Brachiopoda* other than the two mentioned, only a few isolated examples have been found. Among all the collections which I have examined, probably not more than fifteen individuals in all have been discovered. The following described species are all that have been found in any of the marls within the State, including the Eocene beds at the top of the Upper Marls.

Class BRACHIOPODA.

TEREBRATULIDÆ.

TEREBRATULA Llhwyd.

Terebratula Harlani.

Plate I, Figs. 15–23.

Terebratula Harlani Morton. Am. Jour. Sci., 1st ser., Vol. XVIII, p. 250, Pl. III, Fig. 16; and Vol. XVII, p. 283. Jour. A. N. Sci., 1st ser., Vol. VI, p. 73, Pl. III, Figs. 1–4 and 7, 8. Synopsis, p. 70, Pl. III, Fig. 1, and Pl. IX, Figs. 8 and 9; also Fig. 2. Gabb, Synop. Cret. Form., p. 196. Synopsis of Cret. Brach., p. 18. Meek, Geol. Rept. N. J., 1868, p. 729.

T. perovalis (Sow.?) Morton. Jour. A. N. Sci., Phil., Vol. VI, 1st ser., p. 77, Pl. III, Figs. 7 and 8.

T. fragilis Morton (not of Schlot.). Jour. A. N. Sci., Phil., Vol. VI, 1st ser., p. 75, Pl. III, Figs. 3 and 4. Synopsis, p. 70, Pl. III, Fig. 2. Am. J. Arts and Sciences, Vol. XVIII, p. 250, Pl. III, Fig. 17 and Vol. XVII, p. 283. Meek, Geol. Rept. N. J., 1868, p. 723.

T. camella Morton. Synopsis, p. 70, in text.

T. subfragilis D'Orb. Prod. Pal., Vol. II, p. 258.

T. atlantica (Mort.) Gabb. Synop. Cret. Brach., Proc. A. N. Sci., Phil., 1861, p. 18.

Shell large, sometimes measuring two and three-fourths inches in length. Form, elongate-oval with subparallel sides, often giving a somewhat cylindrical form in old specimens as seen in a dorsal view, with the front usually more or less truncate and sometimes bilobate from a flattening or lobing of the valves on the anterior part of the shell. Valves very ventricose, almost gibbous in old shells from a thickening of the margins. Ventral valve with the beak large, strong, incurved, and truncated at the apex by the large foramen, which is strongly excavated at the opening through the thickness of the shell-substance of the apex, the truncation being parallel to the axis of the valves. Lateral margins of the beak, angular. Center of the valve toward the front usually flattened or concave, and the lateral slopes impressed. Dorsal valve much less deep than the ventral; the beak small and invariably incurved within the deltidial opening of the ventral in half-grown or mature specimens; front and anterior surface of the valve flattened or concave, leaving an angular ridge dividing the central area from the lateral slopes. This latter feature is frequently exaggerated to so great an extent as to give a decidedly plicate appearance to the front half of the shell. Shell-surface marked by numerous lines of growth, often grouped so as to form varices of growth toward the front in old specimens. Shell-substance finely punctate, the punctæ usually visible under a hand-magnifier of moderate power; more distinctly seen, however, on exfoliated surfaces. In the interior the crura are slender near their junction with the dorsal valve, but rapidly expand into a broad loop of from three to five eighths of an inch in length and more than two-thirds as great a width, and very angular at the bendings. There have been two varieties of this species described under distinct names, *T. ovalis* and *T. fragilis*, Morton. There may be some reason for regarding the latter as a good species, as it occurs in beds where the other form is scarcely or not at all represented. This is, I believe, notably the case at Harrisonville, New Jersey. The characters of these varieties are separately noted below.

Variety *fragilis*, = *Terebratula fragilis* Morton, Pl. I, Figs. 15–18. This form is common enough at nearly all localities where the species occurs. It is found of all sizes, from a little more than an inch in length to those nearly as large as the normal form of the species. It is usually, however, smaller in size, more cylindrical, and very strongly plicated; the plications frequently forming strong lobes and extending to within half an inch or so of the beak on the dorsal valve and nearly as far on the ventral. I can find no feature which will serve to distinguish this form from the normal type of *T. Harlani* constant enough to be relied upon. The thinness of the shell is no greater than that of the generality of those of the other form. There is a decided and marked difference in the size and character of the punctæ of the shell observable in some individuals of this variety, the pores being smaller and much more densely crowded together, forming transverse wavy lines, which, if it were a constant feature, would serve to distinguish them, but even on the specimen where this feature is most marked, I find that it varies even on different laminæ of shell over the same space where it has been exfoliated artificially, so that it forms no positive means of distinction. I am inclined, therefore, to regard it only as a very strongly marked variety, and not a valid species.

Variety *perovalis*, Pl. I, Fig. 19. This form Dr. Morton identified with the European shell *T. perovalis* Sowerby, but it can be nothing more than a two-thirds grown form of *T. Harlani*, and the name has long since been dropped out of the literature by most authors. He afterwards proposed the name *T. camella* for it, if found to be distinct from *T. Harlani*.

Terebratula Harlani is about the largest terebratuloid shell known in American rocks, and is one of the most beautiful, as well as the most abundant. At several localities where it is found, it occurs in immense numbers, forming, in connection with *Gryphœa vesicularis*, nearly or quite half the substance of beds of several feet in thickness. At the marl pits, about one and a half miles from New Egypt, they are found through about eight feet of sandy marl so densely packed together that it is almost impossible to extricate specimens without breaking, and in certain parts of the bed the marl forms much less than half the bulk of the whole. Through about two or three feet of the upper part of the bed the *Terebratula* is almost alone, mostly in separated and water-worn valves, but near the upper portion of this thickness perfect shells can be obtained in great numbers. The Terebratula bed is an excellent line for comparison of the strata at different localities, and has been traced throughout a large part of the State and into Delaware. The shell has been obtained from South Carolina, where it is said to be found in the Tertiary. This I think extremely doubtful, as it is never found above the middle marl beds in New Jersey. Moreover, the strata in South Carolina are in such a position that it may easily be obtained from the Cretaceous layers below without the fact being detected. Specimens in Dr. Holmes' collection in the American Museum of Natural History certainly present all the appearances of the Cretaceous shell, but are larger than any I have seen from New Jersey. Mr. Gabb, in his Synopsis, cites *T. atlantica* Morton as a synonym of this, considering it as a young individual. But I judge from Dr. Morton's description that it is a very distinct species, being small and distinctly marked with radiating striæ, which *T. Harlani* never is so far as I have seen. I should be much more inclined to think *T atlantica* Morton more nearly related to Mr. Gabb's *T. Halliani.*

Formation and locality.—The species is confined, so far as I know, to the top of the Lower Marl Bed and to the Middle Marls, not having been seen to any extent in the lower beds and never in the upper beds, at least within the limits of New Jersey. It has been found in the lower beds near New Egypt, and in the middle beds at the same pits, where it is extremely abundant through about eight feet of strata, also at Timber Creek, at Mullica Hill, and at Kirby's marl pits, two miles southwest of Harrisonville, N. J., in the amber deposit on Old Man's Creek. (G. F. Kunz.) The two latter localities furnishing many specimens of the variety *T. fragilis.* It is found in the middle layers at very many localities and sparingly throughout the entire bed in New Jersey and in Delaware. It also occurs in South Carolina, as shown in Dr. Holmes' collection in the American Museum of Natural History, New York City, from Mazyck's green sands, at Saint John's, and is marked by Dr. Holmes as Eocene, probably an error.

Terebratulina atlantica.

Plate I, Figs. 10–13.

Terebratula atlantica Morton. Jour. A. N. Sci., Phil., 1st ser., Vol. VIII, p. 214.
T. *Halliana* Gabb. Proc. A. N. Sci., Phil., 1861, p. 19.
T. *glossa* Conrad. Am. Jour. Conch., Vol. V, p. 42, Pl. I, Fig. 22. Meek, Geol. Surv. N. J., 1868, p. 732.
Terebratulina Halliana Gabb. Synopsis, p. 200. Meek, Geol. Surv. N. J., 1868, p. 724.

Dr. Morton describes this species as follows: "Shell ovate, valves equally convex, with numerous, distinct, and bifurcating striæ, most prominent on the umbo; foramen large; beaks not incurved. Length of the largest specimen found, five-eighths of an inch; width, half an inch." The locality he gives as in the ferruginous sands at Woodward's farm, New Jersey.

I have seen a goodly number of this species from New Jersey, but most of them have been smaller than the dimensions given by Dr. Morton, and are nearly all internal casts. In this condition they frequently afford evidence of radiating striæ, and correspond with the description given above, but are different in form from those more advanced stages of growth. As they advance in size the form changes from this nearly equivalve, lenticular form, by the front of the valves becoming elevated, forming a fold on the dorsal side and a broad, shallow depression on the ventral. This feature is increased with increased growth until they assume the form given by Mr. Conrad for his *Terebratula glossa.* The form is then elongate-ovate with very convex valves, the front of which is somewhat produced into a pinched fold on the upper valve, and with a shallow depression on the opposite one corresponding to it. The beak of the ventral valve becomes slightly incurved and is largely truncate, and its lateral margins subangular. The ventral valve possesses a slight cardinal area on each side of the foramen, which is flattened, and the dorsal valve has lateral expansions on the sides of the beak to correspond, and which form a slightly extended cardinal line on each side of the beak. This is shown on the medium-sized cast figured in the pouching of the lateral margins on the sides of the beak of the dorsal valve, but it is not distinctly observable in the larger figure, nor on the one copied from Mr. Conrad. On the former specimen the striæ are fine and even, but as it does not retain the shell they are not seen on the upper part of the specimen.

Dr. Morton first described this species from young specimens, and Mr. Gabb seems to have considered it as identical with the young of *T. Harlani* (see Synopsis, p. 194). This could not be the case with a shell possessing the features described by Dr Morton. Mr. Gabb also considered the small shells as the same as *T. lachryma* Morton; being misled by specimens labeled by Dr. Morton (see Synopsis, p. 200, foot-note), on ascertaining his mistake he described the New Jersey shell as *T. Halliana.* Mr. Conrad subsequently obtaining adult specimens described and figured them under the name *T. glossa*, supposing it to come from the Eocene beds at Shark River, New Jersey, which is a mistake. I believe them all to be only stages of growth of one species; at least I have not seen specimens that I should consider as representing distinct species when they are examined together and in numbers. There are some of the small ones which are rather more ventricose than the majority, but not sufficiently so to be specifically distinct. The young shells of this species differ from *T. lachryma* Morton, in being less ventricose on the umbo, less elongated in form, more circular in outline, with a shorter and broader beak. They must very closely resemble *T. floridana* Morton, from the Cretaceous at Prairie Bluff, Ala., but, as I have no specimen from that locality for comparison, I am not able to assert positively in what particulars they differ. If they prove to be indentical, the name *T. floridana* will have precedence over that of *T. atlantica.*

Formation and locality.—All the specimens which I have seen, and of which I have been able to ascertain the locality without doubt, have been from the lower beds of the upper marls. The form given by Conrad as *T. glossa*, I have seen from Farmingdale in the collection of Miss F. M. Hitchcock, of New York City (Plate 1, fig. 13). The example figured on Pl. 1, fig 10, is from the collection of Dr. L. Johnson, of New York, and is also from Farmingdale. Other and smaller specimens, but showing the same features, except in being less gibbous, are from the same horizon at Shark River, N J., Columbia College collection. I do not remember to have seen any specimens authentically derived from either a higher or lower locality. Mr. Conrad's examples of *T. glossa* were from Shark River. Mr. Gabb gives for *T. Halliana* simply "New Jersey." Dr. Morton cites for his specimen the "ferruginous sands at Woodward's farm, New Jersey, found by Mr. Conrad."

Terebratulina floridana.

Terebratula floridana Morton. Synopsis, p. 72, Pl. XVI, Fig. 17.
Terebratulina floridana (Mort.) D'Orb. Prod. Pal., p. 258, Vol. II; also of Gabb, Meek, and others.

This species was originally described from the Cretaceous formations at Prairie Bluff, Ala., but is given by Mr. Meek as a New Jersey species in his catalogue in the Geological Survey of New Jersey for 1868, p. 729. So far I have not observed it among the fossils of this State, and am inclined to think the reference an error. Young individuals of *T. Halliana* (Gabb) = *T. atlantica* (Morton) have very much the characters of the Alabama shell, but they differ in being more elongate, less broadly rounded, and in having a shallow sinus on the dorsal valve, while the Alabama shell is described and figured without this feature. I do not, therefore, consider it as properly belonging to the State fauna.

Terebratulina lachryma.

Plate I, Fig. 14.

Terebratula lachryma Morton. Synopsis, p. 72, Pl. X, Fig. 11, and Pl. XVI, Fig. 6.
Terebratulina lachryma D'Orb. Prod. Pal., p. 396. Gabb, Synop. Cret. Brach., p. 19. Proc. A. N. Sci. Phil., 1861; Synopsis, p. 200.

Mr. Gabb states that he has seen this species from the Cretaceous marls of New Jersey, and therefore he considers it as a Cretaceous species, remarking that D'Orbigny is incorrect in placing it in the Lower Eocene. Dr. Morton's specimens were from the calcareous strata of South Carolina, which is considered as Eocene, although at the time Dr. Morton described the species it was supposed to be Cretaceous. He also states that Mr. Conrad had at a later time obtained it from "strata below Claiborne, Ala." This would also bring it into the Eocene. Mr. Meek, in his check-list of Cretaceous Mollusca, does not include this as a Cretaceous species, and, although Mr. Conrad does not include it among the Eocene Terebratulidæ in his Smithsonian Institution check-list of that formation, he does subsequently in a later list published in Vol. I, Am. Jour. Conchology. I do not know what Mr. Gabb may have seen from New Jersey to identify as belonging to this species, but I certainly have never seen any shell or cast of shell from New Jersey that I should consider as belonging to it. In order that it may be identified if found, I have given a figure, enlarged to twice the natural size, of a specimen of undoubted authenticity, from the white limestones of the Eocene of South Carolina, near Charleston, for comparison.

Genus TEREBRATELLA D'Orb.

Terebratella plicata Say.

Plate I, Figs. 5-9.

Terebratula plicata Say. Am. Jour. Sci. and Arts, Vol. II, 1st ser., p. 43. J. A. N. S., 1st series, Vol. VI, p. 73, Pl. III, Figs. 5 and 6. 1829.
T. Sayi Mort. Synopsis Org. Rem., p. 71, Pl. III, Figs. 3 and 4. 1834. Am. J. Arts and Sciences, Vol. XLVIII, p. 283.

Terebratella plicata (Say) D'Orb. Prod., p. 259. Gabb, Synop. Cret. Foss., p. 193. 1861. Meek, Geol. New Jersey, 1868, pp. 375, 723.

Shell of medium size, subcircular in outline and somewhat plano-convex in profile, marked by from eight to twelve or more sharply angular plications, which extend from beak to base. Ventral valve strongly convex, with an erect beak of small size, which is angular on the back but not incurved. Area moderately large, and perforated by a large circular foramen and broad triangular deltidium, which is partially closed by a small deltidial plate on each side. Dorsal valve flattened or slightly convex, often with a broad undefined sinus in the middle, which may be occupied by a single strong plication or by three or five smaller ones. Surface of the shell marked by numerous strong concentric lines of growth crossing the plications, and the minute structure of the shell beautifully and strongly punctate, the punctæ being arranged in quincunx order, so as to form oblique lines across the plications. In the interior of the ventral valve the cardinal muscles have left a pair of strong flabellate scars occupying the upper third of the valve, and in the dorsal the adductors show deep semi-circular pits of moderate size separated by an elevated mesial septum which extends to some distance beyond the middle of the valve. The teeth-sockets are large and deep, and the cardinal process double or in some cases triple, nearly erect, and of large size. The crura start from a more or less well-developed hinge-plate at a moderate distance from each other, and are directed forward and outward, giving origin to crural process at a short distance from the hinge-plate. The loop is formed of a rather broad band or ribbon, which curves outward from the crural points and forms an imperfect circle of nearly one-half the diameter of the valve, and of equal length, the two sides nearly meeting in front, where they are bent upon themselves and, returning at a short distance above the main portions, are united in a transverse bar just in front of the crural points. The main portions of the loop are united to the central septum of the dorsal valve by a transverse plate near the end of the septum and just in front of the middle of the loop, thus giving a double attachment to the loop, as in the living forms of the genus. Among several specimens examined showing the loop more or less perfect, the ventral side of the band comes so near to the ventral valve that the minute crystals with which both the loop and the interior of the valves is coated bring it in contact with the valve, so that in breaking away the shell to show the interior this part has been somewhat injured on one side of each specimen. There is considerable difference observed in the proportional form of the different parts of the loop in different specimens, in the width of the band composing it, in the relative width between the bands on the opposite sides of the center, and in the proportional length of the transverse plate which connects the dorsal sides of the ribbon with the median septum of that valve. Moreover, the ribbon in all cases where seen is coated with minute crystals of lime, which gives it a much stronger appearance than it has really possessed when in its normal condition. The loop in its general appearance presents much the same aspect that is seen in that of *Waldheimia australis* of the present time, except that it has the double attachment to the dorsal valve characteristic of the genus *Terebratella.* The general shape of the shell externally had long ago decided naturalists in referring the species to *Terebratella*, but it has hitherto disappointed all efforts to obtain a knowledge of its loop; but as it is now known in several individuals, there can no longer be any doubt of its generic relations.

Formation and locality.—This is an abundant species at most of the localities where the shell-bed of the Lower Green Marls is worked. At Cream Ridge, New Jersey, it is extremely abundant; also at Middletown, New Jersey.

Terebratella Vanuxemi.

Plate I, Figs. 1-4.

Terebratula Vanuxemi Lyell and Forbes. Quart. Jour. Geol. Soc., 1845, Vol. I, p. 62.
Terebratella Vanuxemi D'Orb. Prod. Pal., p. 259. Gabb, Synopsis Am. Cret. Brach., P. A. N. Sci., Phil., 1861, p. 18. Synop., p. 194. Meek, Check-list, p. 5. Geol. Surv. N. J., 1868, p. 724.

Shell resembling *T. plicata*, Say, in size, form, and general characters, varying only in the greater convexity of the valves, especially the dorsal valve, and in the greater number of plications, which are less angular and not so distinctly elevated or so distinctly marked. The ventral valve is sometimes slightly flattened in the middle region instead of having plica tions, as in *T. plicata.* On some individuals the plications are all but obsolete, being very faintly marked on the central portions and obliterated toward the front of the shell by the strong concentric lines and varices of growth. The punctate structure of this shell is about the same as that of *T. plicata.*

This shell has been very generally admitted as a valid species by Palaeontologists; still I have very great doubts of its specific distinction. It occurs at nearly all, if not quite all, localities where *T. plicata* is found, but is quite rare in its typical character. Individuals can be selected very readily from any of the localities where it is found that will unite by insensible gradations the utmost extremes attained by the two forms. I have not seen the internal features of this form to know if they agree with those of *T. plicata*, as specimens presenting the features of the species in good degree are too rare to be sacrificed in an uncertain attempt to develope them.

Formation and locality.—Usually found associated with *T. plicata*, Say, at most of the localities where that one occurs, and only in the Lower Marl Beds associated with *Gryphœa vesicularis*, *Exogyra costata*, etc.

LAMELLIBRANCHIATA.

Class LAMELLIBRANCHIATA.

I have preferred the use of the name *Lamellibranchiata* for this group of mollusks, because it appears to me more applicable than any other one of the very many names proposed. It may be objected that it is a long and difficult name, but that is its only objection; while most of the others either imply zoological falsehoods when applied to some portions of the group, or are equally applicable to other groups than this one, and I do not see but that the name I have adopted is as generally used, or even more generally used, at the present time than any other. There seems, however, to be a growing tendency with many Conchologists to use the name *Pelecypoda*, proposed by Goldfuss in 1820 (meaning hatchet-footed), which, to my mind, is particularly objectionable, as there are large groups of these animals where the foot is entirely obsolete, or so nearly obsolete as to be without definite form. I do not, however, think this the place to enter into an elaborate discussion of this matter, but will refer those who wish for knowledge on these subjects, to the various manuals of mollusca which have been published, and particularly to the very learned and able remarks of Dr. Stoliczka in the opening chapter of his work on the "*Pelecypoda*" of the Cretaceous rocks of Southern India, Palæont. Indica, Vol. 3, p. 7, *et seq.*, although I entirely disagree with his choice of name for the group.

In regard to the matter of arrangement or classification which I have adopted in the work, I have a word to say. It will at once be noticed by almost every modern student of conchology that my arrangement is old, and that it is nearly the reverse of that used by writers on recent conchology. My reason for this is that it accords so much more nearly with the course of nature, as evinced by the successive appearances of the different groups in the geological record. By this I mean an arrangement from the lower toward the higher in zoological structure. It may be said in contradiction of this statement that the oysters, for instance, which by many are classed as the most lowly organized of the entire group, do not appear at all in the Palæozoic formations.[1] But this may prove to be a retrograde from a higher type, and not invalidate to any very great extent the statement above made. In arranging and classifying the fossil mollusca with other forms of animal life in a palæontological collection I find it most convenient and instructive to classify them in this way; and I also find that it leaves a by far less number of breaks and gaps in the chain of succession than when the arrangement is made in the opposite direction. Had it not been for this circumstance I should have arranged them after the other method, had it been for no other reason than that I should prefer to conform to that generally accepted by other writers if it were possible without conflicting with nature's own arrangement.

In the adoption of generic divisions among the very imperfect material for generic distinction with which I have had to work, I have been governed by reasons which have forced themselves upon my mind as I have progressed with the work. When I first commenced to study and classify the forms under consideration, I was much inclined to throw aside most of the more recently proposed generic divisions founded by Mr. T. A. Conrad upon such poor material, and often upon a single imperfect cast of a single valve. But I have found that in many instances, where among later collections than those he at first used, the shells themselves were found preserved, they show strong generic differences, and afford in most instances fully as good grounds for separation as those usually adopted among recent shells; consequently I have been compelled, almost against my own will, to accept his divisions. While in other cases I have found it totally impossible to establish any refutation of their value; so that in the end I have concluded to adopt the generic divisions nearly as proposed by him, offering only a few criticisms by the way. This, I think, will perhaps prove in the end the most satisfactory manner of dealing with the very imperfect material with which I have had to work. The great difficulty of obtaining collections has been the greatest drawback with which I have had to contend. The specimens are mostly internal casts poorly preserved in a soft friable material, which is strongly impregnated with pyrite, so that they readily decompose and crumble, making it impossible to preserve them for any length of time. For this reason, collections made a few years ago of apparently good fossils, are represented at present only by a few shapeless masses of marl and a quantity of loose sand; and I present this as an excuse for illustrating such imperfect material as will be found on the plates. If collectors would take their marl specimens when first collected, and after cleaning and shaping them as desired, soak them carefully and thoroughly in boiling glue-water, then dry them rapidly, they might be preserved in good condition for a very long time. But this is seldom done.

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[1] There is only one species of true *oyster*, so far as I know, described from the Palæozoic rocks. This one, *Ostrea patercula*, Winch., described as coming from the Waverly sandstones at Burlington, Iowa, I had the privilege of seeing some years ago; and I am perfectly confident that it is a young specimen from the yellow limestone sands of the Middle Marl Beds of the Cretaceous of New Jersey, which had gotten by some means mixed among the Waverly group fossils by accident.

SECTION II.

LAMELLIBRANCHIATE SHELLS FROM THE PLASTIC CLAYS.

The following five species of *Lamellibranchiate* shells are from the plastic clays in the townships of Woodbridge, East Brunswick, and Sayreville. These clays are supposed to hold a position stratigraphically below the lowest of the green marls, and are consequently older, although their true geological position does not appear to be very well determined. Some of the layers of these clay beds furnish plant remains in large numbers, many of which were submitted to Prof. L. Lesquereux some years ago, who identified a considerable number of the species, and, basing his remarks upon these plants, gave it as his opinion that they represented the flora of the Dakota group of the West, Cretaceous No. 1, of the Upper Missouri section. I am not aware that any other opinion has been expressed of late years as to their distinct equivalents in other parts of the country or in Europe. In 1868 Mr. T. A. Conrad described two species of shells from these clays and pronounced them Triassic (Am. Jour. Conch., Vol. IV, p. 279), stating that Professor Rogers had previously considered them as forming the lowest part of the Cretaceous formation, but that he (Mr Conrad) had ascertained them to be Triassic. That they contained abundant leaves and stems of *Cyclopteris*. It will be seen by reference to Professor Lesquereux's list published in the "Report on Clays" (Geol. Rept. N. Jersey, 1878, pp. 28 and 29), that Professor L. does not include this genus among those examined and reported upon. We may, therefore, consider that Mr. Conrad may have been mistaken. Professor Cook also states, on page 29 of the same report, that two specimens of shells only had then been collected from the clays, and that these had been examined by Mr. W. M. Gabb, of Philadelphia, who determined them to be *Cucullæa antrosa*, Morton. I am not sure that I have ever seen these two shells, but among all those which I have seen, twenty or more, none of them would readily be mistaken for that species. Imperfect casts of the one I have referred to *Gnathodon* might possibly resemble them in some cases, but not strongly. All these forms found in the clays are estuary shells, and strongly indicate an estuary formation, which it undoubtedly is. The generic characters of all of them are obscure and cannot be positively affirmed, as their interiors are unknown. They would seem to represent *Gnathodon*, *Astarte*, and *Corbicula;* and the one most common, a new genus which I have called *Ambonicardia*, but none of these would serve to definitely fix the geological horizon of the beds in which they occur without other evidence. *Gnathodon* is known to occur in the Cretaceous, but I think not below, some of the older species having been proved to belong to the genus *Rangia*. *Astarte* is known in the Jurassic and possibly below, but most of the Carboniferous species have been shown to belong to other genera; while *Corbicula* certainly occurs in the Cretaceous and probably below. The new genus, which I have named *Ambonicardia*, is related to *Homomya* and to the smooth forms of *Pholadomya*, but it will not answer for either. Consequently we get no help of sufficient value to establish the geological horizon of the beds from these molluscan remains, and aside from the evidence furnished by the plant remains we must rely entirely upon the stratigraphical position.

In looking over the forms of *Lamellibranchiate* shells from the Jurassic formations in the vain effort to find some genus under which I could class this new form, I have been thoroughly impressed with the feeling that it was more intimately allied to the Jurassic forms than to any of those from the European Cretaceous. And I have a feeling, resting upon this evidence alone, that the beds in which they occur represent that period on our eastern border. But the evidence is not sufficient to give basis for a positive opinion.

ASTARTIDÆ.

Genus ASTARTE Sowerby.

Astarte veta.

Plate II, Fig. 1.

Astarte veta Conrad. Am. Jour. Conch., Vol. IV, p. 279, Pl. XX, Fig. 4 (Fig. 5 by error on descriptions of plate, see Vol. V, p. 227).

Mr. Conrad describes this species as "Ovate, from ventral margin to beak compressed, equilateral; beaks prominent, oblique; anterior ventral margin rounded, posterior obliquely truncated; posterior end truncated and situated much above the line of the base (cast)." In comparison he says, "this species is nearly allied to, if not identical with, *Astarte Triasina*, Dunker."

I have not been able to obtain specimens agreeing with the above description, nor to find the type specimen used by Mr. Conrad. The form of the shell would indicate that it belonged to the genus *Astarte*, but beyond that there appears to be no real evidence of its generic relations more than there is to other species found in these clays. The outline of the shell might suggest that it was a young individual of what I have herein called *Gnathodon tenuidens*, but the apparent want of gibbosity would not agree. So for the present at least the species will have to be left as it is.

Formation and locality.—Mr. Conrad cites it as coming from the "ash-colored clay near Washington, Middlesex County, New Jersey."

CYPRINIDÆ.

AMBONICARDIA, n. gen.

Shell bivalve, large and heavy, triangularly-rhomboidal in outline; beaks anterior, large, ponderous, and enrolled. Body of the valves sulcated. Ligament external, large, resembling that of *Unio*. A large well-marked lunule occurs beneath the beaks. Hinge only partially known, but provided with a strong tooth anterior to the center in the left valve; posterior teeth probably obsolete. Anterior muscular scar deep, placed well anterior; pallial line simple. Exterior coated with an epidermis. Type *A. Cooki.*

The shells for which the above name is proposed very closely resemble that section of the genus *Unio* which is typified by *U. pyramidata*, common in the Ohio and Mississippi watershed, differing externally only in having a strong lunule. They are probably closely related to the genus *Veniella* and allied Isocardias; but they differ so strongly from any of them, that it appears unnatural grouping to place them in any of the established genera. They are as near *Veniellicardia*, Stoliczka, as to any one, but so far as I can judge from a large number of imperfect specimens, there seems to have been no lateral teeth, or any thickness of shell for such. They also seem to be allied in general form to *Homomya*, Ag., and to some of the smooth forms of *Pholadomya*, but in the lunule and the thickened shell, are different. Very little is really known of the hinge characters, but on some of the best casts the imprint of a strong tooth on the left valve in front of the line of the beaks shows relations to *Veniella*. I am in hopes to obtain better material for illustrating the genus before the completion of this work.

Ambonicardia Cookii, n. sp.

Plate II, Figs. 11-14.

Shell large and ponderous, with heavy, massive, incurved beaks, which are strongly enrolled and situated near the anterior end of the shell. Valves very gibbous, very inequilateral and transverse, strongly cuneate in a cardinal view when united, being extremely ventricose opposite the beaks and gradually but rapidly decreasing in depth toward the posterior end; obliquely ovate in outline, with a short, obtusely pointed anterior end, straight but short cardinal line; prolonged but obtusely rounded posterior end; basal line strongly curved, rapidly declining from the anterior end, and distinctly sinuate near the middle of the shell by a broad, shallow, but well-defined oblique sulcus, which passes from the beak to the basal margin just in front of the strongly rounded and prominent umbonal ridge. External ligament strongly marked, and extending the length of the posterior cardinal line and deeply imbedded in a narrow escutcheon. Lunule large and deep, strongly defined, with sharply angular margins. Substance of the shell thick and dense, and the surface marked with close comparatively strong concentric lines or ridges, and apparently with a thick epidermis. Anterior muscular scar large and deep, situated close to the margin in the pointed anterior end Other muscular imprints not determined and the features of the hinge are as yet unknown. Pallial line apparently simple.

The general features of this shell remind one of a deep-valved and strong-beaked *Unio*, but the hinge has certainly been destitute of lateral teeth, and the form and position of the anterior muscular impression is such as at once to preclude all possibility of its reference to that genus.

Localities.—The species has been obtained from the clays at Sayre and Fisher's banks near Sayreville, N. J., and at clay banks of R. N. and H. Valentine, near Woodbridge, and at East Brunswick, New Jersey.

Genus CORBICULA Megerle.

Corbicula ? emacerata, n. sp.

Plate II, Figs. 5 and 6.

Shell of rather small size, transversely elliptical or subovate in outline, and moderately ventricose. Beaks moderately large but not prominently so, and situated at about the anterior fourth of the length of the shell. Anterior end of the shell the highest, the anterior margin narrowly rounded; basal line strongly curved and the posterior end narrow and obliquely truncate, the cardinal portion rapidly sloping with a slight curvature to the extremity of the moderately sized ligament; hinge line short and oblique to the axis of the shell. Umbonal angle distinct but not marked, and the cardinal slope narrow and rather abrupt. Surface marked only by fine concentric striæ, which appear to have been confined principally to the epidermal layer.

The shell is of an unusal form for a *Corbicula*, and may possibly not belong to the genus; but as none of the hinge features are obtainable, it is impossible to determine its generic relations satisfactorily. The surface has been covered with a pretty strong epidermis, and over a large part of the specimen this is the only portion of the original substance preserved; the calcareous portion having been mostly removed by solution.

Formation and locality.—From the clays below the lowest Cretaceous sands; clay banks near Woodbridge, New Jersey.

Corbicula annosa.

Plate II, Figs. 2–4.

Artarte annosa Conrad. Am. Jour. Conch., Vol. IV, p. 279, Pl. XX, Fig. 5 (by error on description of plate, Fig. 4; see Vol. V, p. 227).

This species Mr. Conrad describes at the same time with *A. veta*, in the following language: "Suborbicular, convex, very inequilateral, ventral and anterior margins regularly and nearly equally rounded; posterior end truncated, direct (cast.)."

I have before me two specimens which I have referred to this species. They are both somewhat distorted by compression and retain but little of the substance of the original shell, other than the epidermis, which has been very strong, and a ferruginous replacement of the ligament. The specimens are both very ventricose, with a somewhat subquadrangular outline and a moderately angular umbonal ridge. The beaks are small and nearly anterior, hinge line short and oblique, with a small ligament. Anterior end short and rounded, while the posterior is broadly truncated, corresponding to the rather broad and abrupt postero-cardinal slope. If I have rightly identified the species there can be no reason for referring it to *Artarte* in the light afforded by the two specimens, but every appearance would indicate their relations to the genus *Corbicula*, with which I have placed it.

Formation and locality.—Mr. Conrad's specimen was from near Washington, Middlesex County, N. J. One of the two specimens which I have before me came from the top layers of Sayre and Fisher's brick and clay yards near Sayreville, N. J., and the other from near Woodbridge, New Jersey.

Genus GNATHODON.

Gnathodon? tenuidens, n. sp.

Plate II, Figs. 7–10.

Shell of moderate size, very ventricose, very broadly ovate or subtriangular, with strong and rather tumid, enrolled beaks, which are directed forward and project considerably beyond the line of the hinge. Posterior hinge border gently arcuate, extending more than two-thirds of the distance from the beak toward the basal margin of the shell. Postero-basal angle sharply rounded, and the basal margin broadly arched; anterior end less sharply and more regularly rounded than the postero-basal. Surface of the shell, as indicated on the partial casts and imprints left in the hardened clay, smooth or marked by fine lines of growth only. On the cast of a right valve there are indications of two principal cardinal teeth beneath the beak, and a long, rather slender, lateral tooth. The muscular impressions are not visible on the posterior side, but on one specimen the anterior scars seem to have been large and deep; but this feature is not very satisfactorily determined.

The shell has had nearly the form of *G. cuneata* of our Southern Atlantic coast, but has been a much thinner and more delicate shell with a much narrower hinge-plate, and more delicate and slender teeth, while the shell is proportionally broader along the basal margin, the valves much more ventricose, and the beaks more distant. It is possible the generic features of this shell may not be exactly those of the modern *Gnathodon*, but so far as can be seen on all the specimens examined there seems to be no reasonable doubt of their generic identity. The specimens are all highly imperfect, so much so that the generic features, as exhibited on the hinge-line, cannot be illustrated; and, of course, under such circumstances, it is difficult, if not impossible, to determine definitely the generic relations. The only part of the original substance of the shell preserved on the specimen is the epidermis, which is very distinct on some of them, and a little of the oxide of iron which has replaced the original shell. On one of those figured there is the remains of a species of *Flustra* and fragments of *Serpula*, showing its habitat to have been in sea water.

Formation and locality.—The specimens are from the clay beds below the Lower Marls, at Sayre's and Fisher's brick-yards, and at R. N. and H. Valentine's, near Woodbridge, New Jersey. The specimens are in the State collection at New Brunswick and that of Columbia College School of Mines in New York.

SECTION III.

LAMELLIBRANCHIATA FROM THE LOWER MARL BEDS.

Order ASIPHONIDA.

Suborder MONOMYARIA.

Family OSTREIDÆ.

Genus OSTREA Linn.

Ostrea denticulifera.

Plate III, Figs. 8 and 9.

Ostrea denticulifera Conrad. J. A. N. Sci., Phil., 2d ser., Vol. III, p. 30, Pl. XXXIV; Figs. 1 and 8. Gabb, Synop., p. 152. Meek, Check-list, p. 6. Geol. Surv N. J., 1868, p. 724.

The shells of this species are very small, flattened, thick, and extremely irregular in form. Those originally described by the author seem to have been moderately convex, but the New Jersey specimens are extremely shallow and generally elongated, with the surface obsoletely striate; even on the smoothest specimens the striæ show beneath the surface. The ligamental area is small and the margin crenulate on some individuals to near the front of the shell, the crenulations being strong and tooth-like, and leaving ridges on the sides of the valves as the shells thicken with age. Muscular impression large, lateral, and usually below the middle of the length.

All the specimens of this species observed are upper valves; no lower valves appear to have been collected. Mr. Conrad, in his original description, mentions only "lower valve moderately capacious; upper margins denticulated," features which might have been inferred.

Formation and locality.—The specimens used are from the collection of the Academy Natural Science, Philadelphia, and are marked Haddonfield, New Jersey, and are probably Mr. Conrad's types. I have not observed it in other collections.

Ostrea crenulimarginata.

Plate III, Figs. 10 and 11.

Ostrea crenulimarginata Gabb. J. A. N. S., Phil., Vol. IV, 2d ser., p. 398, Pl. LXVIII, Figs. 48 and 49. Synopsis, p. 152. Meek, Check-list, p. 6.

Shell, as seen in a single upper valve, depressed convex and moderately smooth, of an irregular ovate outline, and marked by but few concentric lines of growth more prominent than striæ. Faint indications of radiating striæ show obscurely, but are more in the substance of the shell than on the surface. On the interior the margin is finely crenulate for two-thirds the length of the valve, being strongest near the hinge and becoming fainter in the forward part. Muscular scar large, reniform, and situated above the middle of the shell.

I have seen but a single upper valve of this shell. It differs in the surface characters from Mr. Gabb's description of the species, but I judge the characters given by him were partly from the lower valve, as he figures none other, and the upper valve would naturally be much smoother than the lower. In other characters it agrees very well. In general features it does not differ very materially from specimens (casts) which I have referred to *O. subspatulata*, L. & S., but the position of the muscular scar is very much higher on the shell.

Formation and locality.—From the lower marl bed, at Marlborough, N. J., in the collection of the Rev. Dr. Schanck.

Ostrea panda Morton.

Ostrea panda Morton. Synopsis, p. 51, Pl. III, Fig. 6, and Pl. LXX, Fig. 10.

This species, although described as a Cretaceous form by Dr. Morton, and recognized as such in all the catalogues of Cretaceous fossils, has proved to belong to the Eocene only; and so far as known to me has not been found in the Cretaceous at any place. There are many specimens of it in the collection of the Academy of Sciences at Philadelphia from the Eocene of the Southern States, and among them the one figured on Plate 19, Fig. 10, of Morton's Synopsis. Examples of the casts, or rather impressions in the marls of *Plicatula urticosa* Morton, often closely resemble some of the smaller forms of this oyster, and it is possible that Dr. Morton's specimen (Fig. on Pl. 3, Fig. 6) may have been such a one.

Ostrea plumosa.

Plate III, Figs. 12 and 13.

Ostreä plumosa Morton. Synopsis, p. 51, Pl. III, Fig. 9. Gabb, Synop., p. 153. P. A. N. Sci., 1876, p. 320; Meek, Check-list, p. 6. Geol. N. Jersey, 1868, p. 724, and others.

Shell small, ovate, ovate-triangular or elongate-spatulate, thin and somewhat fragile irregularly convex on the upper valve, often subangulated longitudinally, either along one side or the other, beak of the upper valve thin, sharp, and pointed; the ligamental area small and inconspicuous in most cases, though sometimes of moderate size. Exterior of the upper valve marked by obscure plications in all the type specimens, which cross the valve obliquely in either direction from right to left or oppositely; also by fine radiating striæ which obscurely diverge from a more or less median line and pass toward the margin on either side. On the interior the margin of the valve near the apex is more or less crenulate. The muscular scar is small and lateral. Lower valve not yet observed.

The type specimens used by Dr. Morton furnish the above characters, his figured specimen being one of them, but he appears to have considered them as lower valves, while they are all upper valves, as the position of the muscular scar and the ridge on the ligamental area would indicate, as well as the obliquity of the valve. Among the collections which I have examined I have observed no lower valves which I can identify with them. Mr. Meek mentions in his Invert. Pal. Geol. Surv. Territ., however, that the lower valve is usually attached by nearly its entire surface. The plications which cross the upper valves obliquely are probably the effects of marking on some other shell, possibly *Exogyra costata*, on which the oyster has grown, and not an organic feature of the species. This I think is plain from the fact that they cross the shell in opposite directions in different specimens. *Ostrea cretacea* Morton, Synop. p. 52, Pl. XIX, Fig. 3 is a very closely allied, if not identical species. It is also often obscurely plicated and striate, the size and position of the muscular scar are the same, but the apex of the valve is proportionally a little wider in the specimens which I have examined. This, however, can scarcely be considered as a specific feature in shells of such variable characters as oysters. A single individual in the same collection with the above is obliquely oval and destitute of surface markings except concentric lines of growth. These indicate that for one-half of its size it was nearly circular, and presenting much the appearance of the lower valve of *Anomia tellinoides* Morton. It is, however, an upper valve of an oyster and of this species. The muscular scar is somewhat larger and a little more central.

Formation and locality.—Dr. Morton gives Arneytown, N. J., as the locality for his specimens, which would place them in the Lower Green Marls. The specimens used in the above description and illustrated are from the collection of the Acad. Nat. Sci., Philadelphia, from whence they were borrowed for the purpose.

Ostrea subspatulata.

Plate III, Fig. 14.

Ostrea subspatulata L. & Sow. Quar. Jour. Geol. Soc., 1845, p. 61, Fig. —. Gabb, Synop., p. 154. Meek, Check-list, p. 6. Geol. Surv. N. J., 1868, p. 724. Gabb, P. A. N. Sci., Phil., 1876, p. 320.

This species has been cited as coming from New Jersey by both Mr. Gabb and Mr. Meek, though I do not know on what authority. The only specimens which I have seen at all resembling the figures of it given in the article in the Geological Society's Journal are casts of young specimens probably. At least they are very small compared with thóse there described and figured. On page 64 of the Quarterly Journal, in a list of species peculiar to New Jersey Cretaceous, Sir C. Lyell mentions this species, but his New Jersey doubtless extended all along the Atlantic coast as far as the green-sand formation appeared; for under the description of the species it is cited only as coming from "Lewis's Creek, South Washington, N. C."

The casts from New Jersey are more or less subovate and a little oblique, slightly concave on the upper side and quite convex on the lower surface; narrowed at the upper end but not sharp; having some width and slightly shouldered. Muscular scars rather large, subovate or subreniform and prominent, situated near the side, and pretty well forward on the valve.

The remains of the shells of this genus are amongst the most unsatisfactory material obtained from the geological formations of the State.

Owing to the great variability among the individuals of species it is nearly or quite impossible to identify with certainty the internal casts, especially where they are taken from collections that have been made by others under circumstances where no note has been taken or preserved of the markings on the matrix. It is therefore with great doubt that I have assigned to any given species the casts which I have examined.

Formation and locality.—From the green clays under the second marl of the Lower Green Sand at the pits of W. Lippincott, esq., Shrewsbury, N. J. In the collection of the Academy of Natural Science, Philadelphia, there is a specimen bearing this name, which is evidently a specimen of *O. compressirostra*, and has the locality marked in ink on the specimen as Chickasaw Bluffs, which I believe is considered as Eocene.

Ostrea tecticosta.

Plate III, Figs. 1 and 2.

Ostrea tecticosta Gabb. J. A. N. Sci., Phil., new ser., Vol. IV, p. 403, Pl. LXVIII, Figs. 47 and 48. Synopsis, p. 154. Meek, Check-list, p. 6. Geol. Surv. N. J., 1868, p. 724.

Shell small, elongate, oval, ovate or irregularly elliptical in outline, slightly curved, with a small, strongly-twisted beak and moderately-sized ligamental area on the lower valve. The lower valve usually shows a large cicatrized area of attachment and is strongly plicated, the plica being usually sharply rounded and very rugose from concentric lamellose lining. The inner margins of the valves are also crenulated on the upper half or two-thirds of their length, and more minutely so on the inner border at the junction of the valves just below the ligamental area. Muscular scar large, but only moderately marked. Upper valves slightly convex and destitute of plications except near the border.

I have only seen a single lower valve of this species from the Cretaceous beds of New Jersey, where it would seem to be a rather uncommon species, though quite abundant in Tennessee. All the shells have an extremely immature look, as if they were the young of a larger shell, but as none such have been observed corresponding in characters, we must admit it as a species for the present. The New Jersey specimen presents much the appearance of a young and shallow individual of *Exogyra costata* in its general shape, and particularly so in its plicated surface, but differs materially in the form of the hinge and ligamental area.

Formation and locality.—The specimen from New Jersey was presented to Mr. Gabb by Dr. C. C. Abbot, of Trenton, N. J., as learned by Mr. Gabb's statements under his original description cited above. But the particular locality is not stated. It however retains a small amount of rather dark green sand in the inside, which leads me to infer it was from the Lower Bed at some locality not far from Trenton, New Jersey.

Ostrea larva.

Plate III, Figs. 3–7.

Ostrea larva Lamarck. An. sans Vert., Vol. VI, p. 216. ? H. & M., Mem. A. Sci. and Arts, Boston, Vol. V, new series, p. 406, M. and H. Proc. A. N. S., Phil., 1856, p. 286. Gabb, P. A. N. Sci., Phil., 1876, p. 320.
O. *falcata* S. G. Morton. A. N. Sci., Phil., 1827, p. 50, Pl. I, Fig. 2. Synop. Org. Rem. Cret., U. S., p. 54, Pl. III, Fig. 5.
O. *falcata* var., *nasuta* Mort. *Ibid.*, Pl. IX, Fig. 6, p. 54.
O. *falcata* var., *mesenterica* Mort. *Ibid.*, Pl. IX, Fig. 7, p. 54.
Comp. *O. pellucida* Meek & H. Proc. A. N. S., Phil., 1860, p. 249. Meek Invert. Pal. U. S. Geol. Surv. Territ., p. 15, Pl. XXVIII, Figs. 4 *a*, *b*.
Comp. O. (*Gryphæostrea?*) *subalata* Meek. Invert. Pal. U. S. Geol. Surv. Territ., p. 15, Pl. XXVIII, Fig. 5.

Shell small, strongly denticulate, and also strongly arcuate laterally, being turned to the left when viewed on the upper side. Hinge straightened, and usually slightly alated on each side, the left side the most distinctly, making the hinge-line often as long or even longer than the width of the valve. Denticulations of the margins strong, sharp, and pointed on the outside; numbering from three to ten, often as long as the width of the valve; those of the inner edge small, forming minute serrations only, usually as many or even more numerous than those of the outer border. Under valve deepest; ligamental fosset distinct; beak often long and pointed and the surface of the valve convex. Upper valve flat on the surface, more particularly so in the region of the beak. Muscular scar moderately large, oval, and distinct, situated near the inner margin and at about the posterior third of the length of the shell.

The shells as found in the Cretaceous marls of the lower beds are somewhat variable. There are, however, two very distinct varieties common. One agreeing with the above description (*O. mesenterica* Mort.), except in the small number of denticulations assigned to the margins; the number being usually from seven to ten. The shell is small, not exceeding half an inch in width and usually much less, while the shell is curved within a circle of one and a quarter inches to one and a half inches in diameter. The other variety, *O. nasuta* Mort., being much larger, sometimes the valves being nearly an inch in width and curved within a circle of about two inches in diameter, while the denticulations vary from three to seven on the outer side, counting the wrinkles of the hinge alations. The differences between these two varieties are so great that were they living shells there would be no hesitation in pronouncing them distinct species.

In the Palæontology of the United States Geological Survey of the Territories (Vol. IX, p. 15), Mr. Meek has given descriptions of two species of *Ostrea* from the Fox Hills group of the Western Cretaceous, under the names *O. pellucida* and *O. subalata*, separating the first-named species from this one of the Eastern Cretaceous, on the want of "auricular appendages," a feature which I find quite common among the New Jersey specimens; and on the less strongly denticulate margins of the shell, which is an extremely variable feature, and the fact that the shell grows attached by the apex, more or less broadly, of the lower valve. While I write there lies before me two New Jersey shells which have grown together, attached to each other for their entire length, showing that this species also seems to have had that same habit to a certain extent. The second one of Mr. Meek's species, *O. subalata*, is so nearly like the variety *nasuta* Mort., that it is very difficult to see wherein lies the specific distinction, more especially as the one before me possesses the alation on the left side only, with beaks exactly parallel to those of his figure given, but is coupled with five very strong denticulations on the outer margin. On examination of the form as it occurs in the Eocene at various places in this country the same variations are detected, although the coarser denticulated variety is less common and not so extreme; and among the European specimens the same changes are visible. In the form given in Sowerby's Min. Conch., t. 135, Fig. 1, as

O. canaliculata the denticulations are almost obsolete; while one given in Goldf. Petraf., p. 10, Pl. LXXIV, Fig. 2, as *O. lunata* Nils., is a very good representative of the var. *nasuta* Morton.

Formation and locality.—The species is common at many of the marl pits in the Lower, Middle, and Upper Green Sands throughout the State, as well as in many of the Southern States in the Eocene sands and clays.

Genus GRYPHÆA Lam.

Gryphæa vesicularis Lam. ?.

Plate III, Figs. 15 and 16; Plate IV, Figs. 1–3, and Pl. v.

Ostrea vesicularis Lam. (1806). Ann. Mus., VIII, p. 160, Pl. XXII, Fig. 3. An. sans Vert., Vol. 6, p. 209.
O. convexa Say. 1820, Am. Jour. Sci. and Arts., Vol. II, p. 42.
Gryphæa convexa Mort. Jour. A. N. S., Phil., Vol. VI, Pl. IV, Figs. 1 and 2, Pl. V, Figs. 1–3. Organic Rem., p. 53, Pl. IV, Figs. 1 and 2.
G. mutabilis Mort. J. A. N. S., Phil., Vol. VI, Pl. IV, Fig. 3. Synopsis, p. 53, Pl. IV, Fig. 3.
Pycnodonta vesicularis (Fischer) Conrad. J. A. N. S., Phil., Vol. IV, p. 275, 1860.
Gryphæa vesicularis var. *aucella* Roemer; Kried. von Texas, p. 74, Pl. IX, Fig. 4.
Comp. *G. digitata* var. *Tucumcarii* (Sow.) Marcou; Geol. U. Am., p. 43, Pl. IV, Figs. 1 *a*, *b*, and 2 and 3.
Comp. *G. Pitcheri* (Con.). U. S. and Mex. Bound. Surv., p. 155, Pl. XXI, Fig. 3 *a–e*.
Comp. *G. Pitcheri* var. *navia.* See Mex. Bound. Surv., Vol. I, p. 155.

Shell varying from depressed convex to highly gibbous on the lower valve, and from flat to deeply concave on the upper valve. Outline varying from subcircular with a very short cardinal line to semicircular, where the cardinal line is of considerable length; the relative proportions of length and breadth being equally variable, sometimes wider than long and again nearly twice as long as wide. Left side, when looking on the flat valve, more or less lobed, often projecting in an extended finger-like anal tube a little below the line of the hinge. Exterior of the shell strongly lamellose, and most distinctly so on the convex side, which often shows strongly projecting concentric lamellæ having free edges; apex of the lower valve often presenting a broad cicatrix of attachment, while many specimens are found which are entirely destitute of any such feature. Upper or flat valve strongly lamellose, especially near the margin of old or thickened shells, and the surface usually marked by strong radiating depressed lines, very tortuous and irregular in their direction, and also by finer interrupted raised lines, which give a somewhat thread-like or fibrous texture to the shell. The valve is flat or slightly concave exteriorly, and of somewhat smaller size than the deep valve. Ligamental area of the lower valve large and strong, broadly triangular, and moderately incurved, with a very distinct triangular depressed central fosset. Inner cardinal margins of the shell strongly crenulate. Muscular imprint large, and situated behind the center of the valve. Ligamental area of the flat valve nearly vertical, and the thickened margin of the shell abruptly beveled on the inside to fit the concavity of the opposite valve.

There are nearly as many varieties of this shell as there are localities from which it is obtained. At least this is the case if all those usually considered as varieties of it are really forms of one species, which statement I greatly doubt. There is not the least question but that in their present condition as imperfect fossils it is extremely difficult to draw a line of specific demarkation between the several varieties which have been noticed and referred to it, but if we had the animal to study as we have in recent forms, there would be but little difficulty in recognizing several distinct and well marked species. The form usually recognized as belonging to the genus *Pycnodonta* Fischer is often so strongly marked as to give one the impression when looking on its upper valve that it is more nearly related to *Placuna* except for the cartilage pit and area. Among the various forms, the following local or rather stratigraphical varieties may be mentioned as worthy of special notice:

Var. *convexa* (Say). This form is very strongly convex on the lower side, and often quite concave on the upper, with a strong anal constriction separating a part of the shell near the hinge line, forming a more or less perfect siphonal tube on the left side, and which usually forms considerable of an angle with the hinge line. The shell is usually wider than long and distinctly subangular on the umbonal ridge of the deep valve, which also shows considerable obliquity.

Var. *aucella* Roemer. Kreid. von Texas, p. 74, Pl. IX, Fig. 4, *a b*. This form, which is figured on Pl. XXVI, Figs. 9 and 10, is usually smaller and quite as gibbous as *G. convexa*, but has only a slight posterior sinus or constriction, and a deeply concave upper valve. It is also less oblique, and more regularly rounded on the back; that is, without the subangular character. It is extremely abundant in the middle marls of New Jersey, where it is almost without any admixture of other forms, and I have seen beds nearly eight feet in thickness composed almost entirely of this shell and *Terebratula Harlani.* They are not at all uncommon in the Lower Green Marls at many localities.

G. Pitcheri var. *navia.* This shell is small, elongate ovate in outline, widening below with a strongly incurved beak, or broad truncation of that of the lower valve, highly concavo-convex with a short hinge line, and destitute of any or with scarcely perceptible constriction. Resembles *G. incurva* from the Jura, but is less incurved at the beak.

Var. *mutabilis* Morton. (Syn. Org. Rem., p. 53. Pl. IV, Fig. 3 (=*Pycnodonta mutabilis*). Shell broadly depressed-convex on the lower side and flat or slightly concave on the upper. Outline more or less circular, with a moderately extended hinge line, which is often more or less arcuate on the outer margin; and with a broad ligamental area. Posterior constriction of the lower valve obsolete or barely distinguishable, not marking the upper valve.

Var. No. 4 (see Pl. III, Fig. 15). Somewhat resembling the last, but less regular in outline and with a straighter hinge line, but with a deep constriction which appears at a late stage of growth and modifies the upper valve to a great degree. It is placed at a considerable distance below the cardinal line, and is deeply bent backwards to nearly the depth of the convex or lower valve.

Of course there are many intermediate forms found scattered through the marls at various elevations and at different localities, which would readily serve to unite all these forms, and especially is this the case if we take into consideration those from other parts of the country and from Europe, but there are many localities where among thousands of individuals, of different stages of growth, pertaining to one of these varieties, one will search long before finding forms enough to satisfactorily link the large ponderous shells with the small highly arcuate but adult shells of the varieties *navicella* and *navia.*

Formation and localities.—Among the specimens which I have examined in the various cabinets, I have seen them from nearly all of the noted localities of the lower and middle green sands of the New Jersey Cretaceous, but they all appear to have been collected with but little care and without any discrimination as to their exact position as regards their stratigraphical relations to the different layers of the formation, so that it is practically impossible to assign any one variety its definite localities or horizon, and this may be said of the majority of all the collections of invertebrate fossils which I have seen from within the State. In fact, to so great an extent is this the case that I find it absolutely unsafe to credit many of the localities which I find assigned to specimens, while by far the greater part are only known as having come from New Jersey, and many others entirely without locality mark of any kind. But little true progress in the study of the Palæontology of the State can be made until collections shall be made with care, and accurate lists of the species from each particular bed given from the various localities. The form *G. navia* has been received from Professor Cook as coming from Monmouth County, and from Blue Ball, N. J.; the *G. navicella* from Blue Ball and Monmouth, New Jersey. I also know it from Freehold and Burlington, in the lower beds, and from Timber Creek and New Egypt, in the middle beds. It is also known to occur at Barrie Bluff and elsewhere in Alabama and in Texas, and is common at many places in Europe. The ordinary form of *G. convexa* is known from Monmouth, Cream Ridge, New Egypt, Harrisonville, near Mullica Hill, and elsewhere in New Jersey.

The form described under the name *Pycnodonta mutabilis* is marked Monmouth County, in Rutgers College cabinet. I have seen it at Cream Ridge in company with *G. convexa*, and the form shown on Pl. IV, Fig. 3, is without local distinction.

Genus EXOGYRA Say.

Exogyra costata.

Plate VI, Figs. 1 and 2.

Exogyra costata Say. J. A. N. S. Phil., 1st series, Vol. II, p. 43. Also of many authors.
Ostrea Americana Desh. Enc. Method. Vers., Vol. II, p. 304, No. 45 (*Gryphæa*). Lam., Anim. sans Vert. (Desh. ed.), Vol. VII, p. 207 (Meek).
? O. torosa Mort. Synop., p. 52, Pl. X, Fig. 1.

Shell large, thick, and ponderous, irregularly circular or subovate in outline, plano-convex in profile and obliquely coiled at the apex, the lower valve sometimes showing one and a half to nearly two volutions in well-preserved adult specimens. Convex valve deep, and on the back strongly angular, especially so in the earlier parts formed, the portion near the beak often being sharply carinate and smooth. Surface of the valve marked by strong radiating costæ, which are round on the surface, and separated by narrow depressions. Costæ frequently bifurcating, and radiating from or dividing along the umbonal ridge; one set curving toward the anterior side and the other toward the basal margin. In old shells the costæ are often more or less obsolete beyond the middle of the shell, where the concentric lamellæ, which everywhere cross the costæ, become much more developed and often form comparatively broad fringe-like expansions. Upper or left valve flat or slightly convex, often becoming slightly concave toward the antero-basal margin in advanced stages of growth, while in many instances both valves conform in producing a deep sinuosity on the anterior side below the beaks. Surface of the flat valve very strongly lamellose on the posterior half, while showing incipient costæ on the anterior side below the apex.

The features of this shell, as it occurs in the Cretaceous beds of New Jersey, are sufficiently well marked and distinctive to leave no room for error in its identification, when medium sized or adult individuals are examined which preserve the normal form of the species. But shells of all this family are so extremely liable to distortion during growth, from external influences, that individuals of any of them may occur which retain but few of the normal features of their species, and this, like others of the group, is occasionally met with departing widely from the general form of its kind. They will be found to vary greatly in the strength and number of the costæ, and in their proportional strength, some examples having been noticed where they were almost obsolete. The same example often shows them well developed on one part, and on another will show scarcely a trace of their existence. The angularity of the umbonal ridge of the right valve is also an extremely variable feature, some having a broadly rounded form nearly to the apex, while others will be extremely sharp and angular with a sub-spinose carination. This difference is not unfrequently the result of the adhesion of the shell, by the anterior side of the beak, to foreign substances, though not always. The very young shell, when of not more than an inch in length, is often so sharply angular and so finely costate that it might well be considered as a distinct species. One example of an adult shell from Prairie Bluff, Alabama, in the American Museum of Natural History, has grown attached to some foreign flat substance over nearly the entire disk of the shell, leaving the walls of the anterior and basal borders standing at right angles to the atached surface. In the conditions of internal casts, a not unfrequent condition of occurrence at many localities, it is more difficult still to recognize its relations, especially so in casts of from one to two and a half inches in length. In these conditions it is seen to be more elongated, and as the inner surface of the flat valve, when young, is liable to be somewhat angularly convex, it then assumes exactly the form and features of *Ex. Texana* of Roemer from the Cretaceous beds in Texas. There is another form of internal cast of a convex valve before me as I write, from the marl beds at Holmdel, N. J., which, although highly convex, approaching gibbosity, lacks that angularity usually seen on the shell itself. The beak of the specimen is broken, and the costæ are few and extremely coarse, while the form is somewhat spreading; and as it is accompanied by the cast of an oyster on the opposite side of the specimen, was at first supposed to be a cast of a very large individual of *O. panda* Morton When, however, the marl was cleared out from beneath the apical portion, the hinge structure of *Exogyra* appeared distinctly.

Mr. Gabb and Mr. Meek both refer Morton's *Ostrea torosa* (Synop., p. 52, Pl. X, Fig. 1) to this species. This reference I presume to be correct, simply on their evidence, as I have not seen the specimen, although were I to judge from the figure given by Dr. Morton I should have supposed it to have been a *Pinna.*

Formation and locality.—This species occurs more or less commonly at nearly all the localities of the Lower Marl Beds of the Cretaceous in New Jersey. It is also known at most of the localities of the formation in Delaware, Alabama, South Carolina, and Texas. Morton also cites it from Tennessee and Arkansas, and Mr. Gabb gives it the range of "all of the United States except the northwest," where I believe it has never yet been noticed. It is also found in Europe.

ANOMIIDÆ.

Genus ANOMIA Linn.

Anomia argentaria.

Plate IV, Figs. 9–11.

Anomia argentaria Morton. Synopsis, p. 61, Pl. V, Fig. 10. Gabb, Synopsis, p. 94. Meek, Check-list, p. 6. Geol. Surv. N. J., 1868, p. 724. Gabb, P. A. N. Sci., 1876, p. 319.

Comp. *A. micronema* Meek. Bull. U. S. Geol. Surv., 2d ser., No. 1, p. 43, 1875. Contrib. to Pal. Dept. Interior, No. 4, p. 57, Pl. XXV, Fig. 2.

Comp. *A. ? obliqua* M. & H. Invert. Pal. Territ., p. 22, Pl. IX, Fig. 2.

Shell small, thin, irregularly circular, and moderately convex on the deep valve. Surface marked by closely arranged, regular concentric lines, at almost regularly increasing distances, and by very fine, hair-like, regular, radiating lines or striæ, which are interrupted at the concentric lines. Surface of the shell nacreous, having a silvery white luster. Perforated valve not observed.

The shell used in the above description is the only one I have seen at all approaching that described by Dr. Morton, in the regularity of the concentric lines. The shell is not as regular in outline as his figure, and he says nothing about the fine radiating striæ seen on this specimen. As compared with shells of *A. tellinoides*, its outline is not more regular, but the apex is situated within the margin of the valve, not being marginal or projecting as in that one, and the regularity of the concentric striæ and the fine radii are certainly distinguishing features. In Kerr's Report Geology North Carolina, Appendix, page 13, Mr. Conrad cites *A. argentaria* and *A. tellinoides* as synonyms. I may be in error in considering this shell as identical with Morton's *A. argentaria*, but if not, I certainly should consider it as distinct from *A. tellinoides*. It bears a striking resemblance to *Anomia micronema* Meek, from the Laramie Group of the west in its general form and in the radiating lines of the surface, and seems almost too nearly like it to be considered distinct, although of a different geological horizon.

Formaticn and locality.—In the lower bed of the Lower Green Sand at Freehold, New Jersey.

Anomia tellinoides.

Plate IV, Figs. 12, 13.

Anomia tellinoides Morton. Synop., p. 61, Pl. V, Fig. 11. Gabb, Synop. Cret. Form., p. 95. Meek, Check-list Smith. Inst., p. 7. Geol. Rept. N. Jers., 1868, p. 427.
A. tellinoides and *A. argentaria* (Mort.). Conrad, Geol. N. C., Kerr's Rept., Appendix, p. 13.

Shell measuring from one inch to one and a half inches in diameter, more or less circular in outline, and irregularly biconvex or concavo-convex in profile. Larger valve generally convex and often inequilateral, with the apex nearly or quite marginal, though sometimes distant from the edge of the valve and more convex than the later portions of the shell. Flat valve with a moderately large opening situated at some distance from the edge of the shell. Shell lamellose or smooth, and one cast shows evidence of plications toward the outer margin.

Formation and locality.—I have seen a single cast, of both valves in position, from the green marls of the Lower Green Sand at Holmdel, and impressions of several convex valves from the white limestone beds at the same locality, but have never seen any of the shells preserved except from near Freehold. Dr Morton does not state from what part of New Jersey his specimen came, although he says it is common in the marls of the State. Mr. Conrad cites *A. argentaria* as a synonym, though on a single specimen which I have identified as of that species there are certainly good specific features.

Genus DIPLOSCHIZA Conrad. 1866.

(Am. Jour. Conch., Vol. II, pp. 77 and 105.)

Diploschiza cretacea.

Plate IV, Figs. 4–8.

Diploschiza cretacea Conrad. Am. Jour. Conch., Vol. II, pp. 78 and 105, Pl. IX, Fig. 203.

Deeper valve anomia-like, deeply concave internally, and most abrupt on the posterior side. Margin entire, and the apex truncate from attachment to foreign substances (?). Smaller valve concave externally, with a notch in the cardinal margin. Surface of the shell marked by very fine concentric lines of growth and a few stronger undulations.

I have seen only one of the deeper valves of this species, and that has the apex broken. The features of the smaller valve are given from Mr. Conrad's figure. I cannot see how the shell differs from the ordinary *Anomia*, and do not think there is the slightest need of the generic division.

Formation and locality.—In the Lower Green Marls at Upper Freehold, Monmouth County, N. J. Collected by Dr. Bruere.

Genus PARANOMIA Courad. 1860.

(Jour. Acad. Nat. Sci., Phil., Vol. IV, pp. 290, and Am. Jour. Conch., Vol. III, p. 8.)

Paranomia scabra.

Plate X, Fig. 10.

Placuna scabra Morton. Synopsis, p. 62.
Placunanomya scabra (Mort.) Gabb. Synop., p. 167.
Placunomia scabra (Mort.). Meek, Check-list, p. 6.
Paranomia scabra (Mort.). Conrad, Am. Jour. Conch., Vol. III, p. 8. Meek, Geol. Surv. N. J., 1868, p. 724.

The type specimen of this species as marked in the collection of the A. N. S., Phil., is a small fragment, scarcely sufficient for generic identification, and when originally described was not figured. The fragment is probably of a lower valve, being very irregular, and is about seven-eighths of an inch in width by about one inch and an eighth long. The surface is marked by irregular radiating costæ, which are rather fine, and covered toward the front of the shell by short spines. There are also strongly-marked concentric lines crossing the shell, which add greatly to the roughness and scaly surface characters produced by the short irregular spines. No portion of the hinge is preserved. Shell thin and fragile.

The specimen might very well be part of the valve of a *Spondylus* so far as its surface characters are preserved, but the shell does not break into longitudinal sections, as do those of that genus when similarly preserved, but seems to divide into concentric laminæ, as would an Oyster.

Formation and locality.—Dr. Morton gives no locality for his specimens, but mentions only that they are from the blue marls. In the collection of the Acad. Nat Sci. it is labeled "N. J. Cret."

Paranomia lineata.

Plate IX, Fig. 10.

Placunanomia lineata Conrad. J. A. N. Sci., Phil., 2d ser., Vol. IV, p. 291, Pl. XLVI, Fig. 20. Gabb, Synop., p. 167.
Placunomia lineata (Con.). Meek, Check-list, p. 6.
Paranomia lineata Conrad. Am. Jour. Conch., Vol. III, p. 8. Gabb, Synopsis, p. 167. J. A. N. Sci., Vol. IV, 2d ser., p. 291.

A single, apparently imperfect valve, which I have referred to this species, occurs in the collection of Rutgers College. It is much larger than that figured by Mr. Conrad above cited, but very similar in form and identical in surface characters. The form is broadly and irregularly ovate, the shell being very thin and fragile. Surface marked by distant elevated ribs, which are irregular in their direction, rounded, and produced into sharp scattered hollow spines at irregular distances, becoming more distant and larger toward the front of the valve. Spaces between the ribs broad and flattened, and marked by faint irregular concentric lines. On the interior the surface is roughened and radiatingly striate to within a short distance of the margin, where it becomes smooth and porcellaneous in character. Hinge margin imperfect, but the portion preserved is roughened, as if for a ligamental surface.

The specimen is imperfect on the umbo, having probably been broken, though the imperfection looks much as if it were a natural perforation for the passage of an attaching muscle, as in *Anomia*. The margin of the opening is thin and sharp, without any appearance of fracture; still it may have been broken. Neither this or the specimens of the following species present any of the features upon which the genus was founded; consequently I am not able to judge of the correctness of the generic reference.

Formation and locality.—From the lower bed of the Lower Green Sand, at Upper Freehold, New Jersey. From the collection of Dr. Bruere.

Genus PECTEN Klein.

Pecten venustus.

Plate VII, Figs. 1-4.

Pecten venustus Mort. Synopsis, p. 58, Pl. V, Fig. 7. Gabb, Syn. N. A. Cret., p. 161. Meek, Check list Smith. Inst., p. 7. Geol. Rept. N. J., 1868, p. 725.
Chlamys venustus Stoliczka. Pal. Indica, Vol. III, p. 429.

Shell quite small, seldom attaining a height of more than five-eighths of an inch, and not commonly of more than half an inch. Form nearly circular below the ears and a little straightened on the cardinal slopes. Valves convex, slightly inequivalve and erect, or not perceptibly inequilateral. Cardinal line about half as long as the greatest width of the valves, which is a very trifle less than the height. Auriculations very unequal, distinctly separated from the body of the shell. The posterior one is quite small and alike in each valve; anterior large, ribbed on each valve, and provided with a moderately distinct notch below in the right one. Right valve most convex, marked by seventeen to nineteen elevated radiating ribs, which are somewhat flattened on the top and are marked by fine transverse striæ. Interspaces narrow and deep. Many of the ribs of this valve become duplicate below the middle of the valve. Left valve depressed, convex, with narrow, sharply-elevated ribs, which are separated by much wider interspaces, and are marked by comparatively distant elevated rugæ. Many of the wider interspaces have a thinner and smaller rib along their middle below the center of the valve, corresponding to the duplicated ribs of the opposite valve.

On the interior of the valves the ribs are distinctly marked, but much more strongly so along the margin of the shell. Cardinal line marked by a single ridge on each side of the center nearly parallel to the hinge line in the left valve, with corresponding grooves in the right. Ligamental pit well marked.

This shell appears to be a true *Pecten* in its characters, but has been referred to the group *Chlamys* Bolton, by Ferd. Stoliczka, probably from the inspection of figures only. The specimens seen are mostly in the condition of complete or partial casts in the marl, but at Freehold, N. J., occur with the shell substance preserved, but of so fragile a character that it is with difficulty they can be cleaned and examined, and then with the beaks usually broken.

Formation and locality.—In the Lower Green Sand at Monmouth, Freehold, Burlington, Arneytown, etc., in New Jersey. The entire shells figured were obtained at Freehold by Miss F. M. Hitchcock, who kindly loaned them for illustration and description.

Pecten quinquenarius.

Plate VII, Figs. 13–16.

Pecten quinquenaria Con. J. A. N. S., Phil., Vol. II, p. 275, Pl. XXIV, Fig. 10, 1854.

Shell of medium size, slightly oval transversely; in outline a little wider than high. Valves plano-convex in profile when united. Hinge line much shorter than the width of the shell below. Ears large, slightly unequal; that of the flat valve (right) somewhat sinuate on the anterior side. Cardinal slope of the valves somewhat concave between the beaks and the lateral margins of the body of the shell. Surface of the valves marked by strong, wide, rounded, radiating ribs, about five on the flat valve and six on the convex valve. On the convex valve, as shown upon the impression left in the fine blue marl, there have been fine, even, and closely arranged concentric lines crossing the folds and passing up over the auriculations; in fact, covering the entire surface of the valve. The opposite flat valve has not been marked by concentric lines, as was the convex valve, the surface of the cast, both inside and outside impressions, being apparently smooth. No remains of radiating lines on the folds can be seen.

There can be no question as to the identity of the New Jersey shells here figured and described with the specimen from Delaware used by Mr. Conrad in his original description, although our specimens show the folds comparatively broader than does his figure. Mr. Conrad's description is very imperfect, and leaves one in doubt as to most of the features of his shell, as he states only that it is "ovate, much compressed, with five distinct ribs, broad and rounded on one valve, narrow and subangulated on the opposite valve. (A cast.)."

Formation and locality.—In the lowest beds of the dark-blue marl of the Lower Green Sands at G.C. Schanck's pits, Marlborough, New Jersey. The only two specimens seen are casts, but the fine marl preserves the surface features of the shell in a remarkable degree of perfection.

Pecten tenuitestus.

Plate VII, Figs. 5 and 6.

Pecten tenuitesta Gabb. Proc. A. N. S., Phil., 1861, p. 327. Meek, Check-list, Smith. Inst., p. 7. Geol. Rept. N. J., 1868, p. 725.

Shell of small to medium size, broadly ovate exclusive of the auriculations, the breadth of the shell being to the height as six is to seven.

Cardinal slopes straight, more than one-third the length of the shell, and the anterior longest. Left valve very depressed convex, most ventricose above the middle; beak small and pointed. Auriculations large, the anterior double the size of the posterior, very slightly rounded on the margin, and perceptibly narrowing below; posterior shorter on the cardinal line than below; anterior side marked by seven sharply-elevated nodose rays, and the posterior by six, with one or two smaller ones between, near the body of the shell. Body of the shell marked by about thirty to thirty-five slender, rounded but unequal rays with much wider flattened interspaces, with an occasional incipient ray on the outer third of the shell. Ribs marked by distant, elevated or subspinose nodes, most closely arranged on the auriculations and obsolete above the middle of the body of the valve. Right valve with the ribs proportionally stronger in the specimens examined than on the left valve and showing a stronger tendency to alternation of smaller and larger ones than on the opposite, while the imbrications of the ribs are not nearly so strong, not rising into spines, as on the left valve. Auriculations of the right valve scarcely perceptibly radiate, while the concentric markings of the valve are more subdued throughout.

So far as I have discovered the species was never figured by its author, but its description is more full than usual, so I think the identification is less likely to be questionable than in some other instances. It would seem to be of the type of *Pecten Islandicus*, although the ribs are less closely arranged and the interspaces are flattened. Among the few specimens which I have examined I have seen no reason to suppose the valves were so strongly bent as to leave them "about half an inch apart in the middle," as the author states.

Formation and locality.—In the Lower Green Marls at Holmdel, N. J., collected at G. C Schanck's pits, near Marlborough, and presented to the New Jersey collection by the Reverend Dr. Riley. It also occurs at Burlington, New Jersey.

Pecten planicostatus, n. sp.

Plate VIII, Figs. 10 and 11.

Shell of medium size, thin and flattened, equilateral, circular in outline, or a little wider than high. Hinge line straight, about half as long as the greatest width of the shell. Auriculations of nearly equal size, but only moderately large, the posterior side on the left valve gradually receding toward the hinge and the anterior one on the same valve sloping in the opposite direction. Cardinal slopes of the body of the shell slightly concave. Left valve marked by from thirty to thirty-five narrow, raised, but slender flattened ribs, with broad flattened interspaces, often six or eight times as wide as the ribs. Ribs increased by intercalations, never by bifurcation. General surface of the left valve marked by very fine, raised concentric lines, which are regularly and evenly arranged but scarcely perceptible to the unaided eye. Interior of the shell showing very faintly the lines of the ribs. Right valve unknown.

In its narrow flattened ribs with wide interspaces this species differs conspicuously from any other species described from the green marls of New Jersey or elsewhere. It presents the general form and proportions of *Camptonectes Burlingtonensis* Gabb; and were it not for the fact that Mr. Gabb has figured both valves of that species and shown them to be destitute of the strong radiating ribs, I should have been inclined to have considered it as the left valve of that species As yet I have only observed the left valve, and am inclined to expect a right valve very similar to that of *C. Burlingtonensis.*

Formation and locality.—In the dark-blue marls of the Lower Green Sands, at G. C. Schanck's pits, near Marlborough, New Jersey.

Pecten (Chlamys) craticulus.

Plate VII, Figs. 17 and 18.

Pecten craticula Morton. Synopsis, p. 57. Gabb, Synop., p. 158. Meek, Check-list, p. 7, Geol. Surv. N. J., 1868, p. 725.

Dr. Morton's type specimen of this species consists of a fragment representing about one-third of one valve. It is a moderate-sized species and possesses very strong rounded ribs, probably ten or twelve in number, the interstices being occupied by a single smaller rib. The ribs, both large and small, are marked on their surfaces by comparatively coarse striations, eight or nine of them on each large rib, and a fewer number on the smaller ribs and interspaces. Strong concentric lines cross the ribs and form rugæ or granules at their junction with the striations. Toward the margin there are strong varices of growth. On the interior of the shell the outside depressions are represented by strong flattened ribs with angular margins and deep grooves between

It is somewhat remarkable that in all the more recent collections no good specimen of this shell has been discovered, or any cast representing it found at any other locality.

Formation and locality.—Dr. Morton states that the fragment was found near Arneytown, N. J., by Mr. Conrad. I have more recently seen other fragments among specimens labeled Vincentown, N. J., which, if correct, would probably place it in the Middle Marl Bed.

Pecten (Syncyclonema?) perlamellosus.

Plate VII, Fig. 7.

Pecten perlamellosa on label in collection of the A. N. Sci., Phil., apparently in Mr. Conrad's handwriting.

Shell small, broadly subcircular, with moderately convex valves. Hinge-line comparatively long and the auriculations large, particularly the posterior one, which extends more than two-thirds the depth of the cardinal slope; both ears distinctly separated from the body of the shell along the cardinal slope, which is sharply and abruptly elevated above their surfaces. Beaks small and pointed, and the cardinal slope diverging at about a right angle to each other. Posterior ear very slightly sinuated or contracted in the lower part, and the anterior one nearly direct on the margin. Surface of the right valve marked by distant, strongly and sharply elevated concentric lamellæ, the spaces between being flat and marked by very fine radiating lines, perceptible only by the aid of a glass. The concentric, raised lamella also pass upward and cross the auriculations in nearly full strength. Left valve unknown. Hinge characters not observed.

It is barely possible that these shells, two of which are before me, may be the young of *C. Burlingtonensis* Gabb, as they have about the same relative proportions and form as that species, but I think it highly improbable from their adult appearance and the strong distant lamellæ of the surface, which, if continued and increased in strength relatively until the shells attained the size common to that species, would have presented a very different appearance from that figured and presented by that species. The larger of the two specimens seen has a height and breadth of very nearly three-fourths of an inch.

It seems difficult to place this species under the genus *Syncyclonema* Meek, on account of the large ears, which feature is in direct contradiction of the features of that genus. Still Mr. Meek himself places *Burlingtonensis* Gabb (*Camptonectes Burlingtonensis* of this work), with which it is possible this may be identical, under it, notwithstanding this feature

Formation and locality.—In the clay marls of the Lower Green Sand at Haddonfield, N. J. From the collection of the Academy of Natural Sciences, Philadelphia, labeled as above in Mr. Conrad's handwriting, but I have not been able to trace the origin of the name or find any description of the species.

Genus AMUSIUM Klein.

Amusium simplicum.

Plate VII, Figs. 11 and 12.

Pecten simplicus Conrad. J. A. N. S., Phil., 2d series, Vol. IV, p. 283, Pl. XLVI, Fig. 44. Gabb, Synop. Cret. Ter., p. 160. Meek, Geol. Surv. N. J., 1863, p. 725.
Sincyclonema ? simplicus (Con.). Meek, Check-list Smith. Inst., p. 7. Gabb, P. A. N. Sci., 1876, p. 319.
Pseudamusium simplica (Con.). Stoliczka, Pal. Indica, Vol. III, p. 420.
Sincyclonema ? simplicia Conrad. A. M. Jour. Conch., Vol. V, p. 99, Pl. IX, Fig. 20.

Shell small, barely half an inch in extreme height, and of equal width; discoid or very depressed convex, nearly or quite equilateral; margins of the shell somewhat regularly rounded; hinge-line a little less than half the width of the shell, and slightly rising from the center toward the extremities. Auriculations moderately large, the anterior side largest, slightly rounded on the outer margin and forming a slight byssal notch at its junction with the body of the shell on the right valve. Cardinal slopes on the right valve straight to near the point of greatest width of the valve, and forming an angle of about fifty to fifty-five degrees with each other and very strongly impressed. Beak small and pointed. On the left valve the posterior ear is the smallest of the two, and the cardinal slopes less strongly marked, not so straight, and extend down the valve not so far as on the opposite valve. Surface of the valves smooth and shining to the naked eye, but under a lens is seen to be marked by fine concentric lines of growth, and on the left valve by faint, incipient, radiating lines.

The above description is taken from specimens from Eufaula, Ala., the locality from which the species was originally described. The valves present every appearance of having been gaping on the sides when perfect, being bent even as seen on the soft marls when preserved only as separated shells; consequently the species would properly be classed as an *Amusium* and not as *Pseudamusium* or *Sincyclonema*, both of which genera are subdivisions only of the other, and differ but very slightly. There is no other form known from the American Cretaceous strata sufficiently resembling it to be easily mistaken for it. *Sincyclonema rigida* H. & M. sp. is the nearest, but it is much more elevated in proportion to its width, being ovate in outline. The ears are smaller, the hinge-line straight instead of depressed in the middle, and the valves are more strongly marked both by concentric lines and radii

Formation and locality.—The only specimens which I have observed from New Jersey were from Monmouth County, New Jersey, and are too imperfect for illustration. The specimens illustrated are from Eufaula, Ala.

Amusium Conradi, n. sp.

Plate VII, Figs. 8–10.

Syncyclonema ? simplicia, Conrad. Am. Jour. Conch., Vol. V, p. 99, Pl. IX, Fig. 20. Not of Meek, Check-list, p. 7.
Not ***Pecten simplicus***, Con. J. A. N. S., Phil., 2d ser., Vol. IV, p. 283, Pl. XVI, Fig. 44, or Gabb, Synop., p. 160.
Not ***Pseudamusium simplica.*** Stoliczka. Pal. Indica, Vol. III, p. 420.
Pecten simplicus (Con.) Meek. Geol. Surv. N. J., 1868, p. 725.

Shell small, seldom exceeding half an inch in height; erect-ovate, becoming more elongate proportionally with increased growth. Valves slightly convex. Hinge short, from half to two-thirds as long as the width of the body of the shell, strongly and distinctly auriculated. Beaks of the valves small and pointed, and the cardinal slopes long, straight or slightly concave, extending to near the point of greatest width of the body of the shell.

Left valve smooth or but faintly marked by fine concentric lines, and a few (five or six) very faint radii. Ears smaller than in the opposite valve, both sloping toward the beak on the outer margin. Right valve marked with crowded concentric folds or elevated lines; also by five or six radiating lines; not always present. On most specimens there are distinctly rounded concentric folds or varices, but on some they are thin, sharp lines; always more crowded and usually finer toward the front, in adult specimens. Ears very distinct; that of the posterior side sloping toward the beak and the anterior one rounded at the extremity and deeply notched.

This shell is very closely allied to *P. simplicus*, Conrad, but differs in being more elevated and in the surface markings, that one being generally smooth or imperceptibly marked. In making these comparisons I have used a number of each valve of the present species from New Jersey, and a fine series of *A. simplicum* from the typical locality, Eufaula, Ala., and it leaves no doubt in my mind as to their complete specific distinction.

Formation and locality.—In the fine blue clay marl of the Lower Green Sand at Haddonfield, New Jersey. The specimens are from the collection of the Academy of Natural Science, Philadelphia, and being borrowed I have not attempted to examine the hinge structure, as they are so very fragile that the least disturbance of the matrix might result in the destruction of the shells.

Camptonectes (Amusium) Burlingtonensis.

Plate VIII, Figs. 3–9.

Pecten Burlingtonensis, Gabb. J. A. N. Sci., Phil., 2d ser., Vol. IV, p. 304, Pl. LXVIII, Fig. 25. Synops. p. 157. Meek, Check-list, p. 7.
Sincyclonema Burlingtonensis (Gabb). Meek, Geol. Surv. N. J., 1868, p. 725.
Camptonectes Burlingtonensis (Gabb). Conrad, Am. J. Conch., Vol. VI, p. 76. Gabb, P. A. N. Sci., 1876, p. 318.
C. bellisculptus Conrad. Am. Jour. Conch., Vol. V, p. 99, Pl. IX, Fig. 11.

Shell attaining a full medium size, one specimen measuring two and a half inches in height, and is equally wide, being nearly circular exclusive of the auriculations. Hinge-line straight, not more than half as long as the width of the shell; ears moderately large. Valves convex, cardinal slopes of the body of the shell concave in their course from the beak, the shoulders of the valves being high and prominent. Surface of the valves marked by fine, even, rounded and thread-like radiating striæ which maintain nearly the same size throughout by their frequent bifurcations, but are less strongly developed on the right valve. On the sides of the valves the striæ curve strongly upward and pass off on the cardinal slopes even within the limits of the auriculations. Ears of the left valve also radiately striate. Besides the radiating striæ the shell is closely marked by elevated concentric lines which form free projecting edges where they cross the radiating striæ, which are more strongly developed and often form fine hair-like spines toward the front of the right valves. The bifurcations of the striæ mostly take place immediately below these concentric lines. Hinge characters not observed, but stated by Mr. Conrad to be crenulated.

The specimen used by Mr. Conrad, in his description of *C. bellisculptus* was of small size, but its general form, as given on the plate cited above, and its peculiar striations, leaves no room for doubt as to its identity with those here used. If the genus *Camptonectes* is to be distinguished by the punctate depressed lines between the striæ, this shell ought not to be classed under it, as they show no evidence whatever of that feature, like those found in the Jurassic rocks of the Rocky Mountains. In fact the striæ on the Jurassic forms are their best distinguishing feature, being formed by impressed lines which are filled with punctures; the striæ being flattened on the top, while these are rounded and wirey in character, and closely pressed together, like the striæ on shells of the genus *Amusium*, and destitute of punctures in the interspaces. From what evidence of the hinge-structure I have seen I do not think this shell possesses the fold or tooth-like ridge characteristic of *Camptonectes*, and the anterior ear of the right valve is certainly much more like that of a true *Pecten* than in the Jurassic species, so that from these evidences I am strongly inclined to consider the shell rather a species of *Amusium* than of *Camptonectes*. I see no reason for considering Conrad's *C. bellisculptus* as a distinct species from the present one. Mr. Gabb's type specimen is a cast and does not retain any of the surface characters, consequently he could not have known its true generic relations, but Mr. Conrad has seen it with the shell preserved and refers it to *Camptonectes*, but does not mention it as being the same as his *bellisculptus*, about which I think there can be no doubt. In the younger stages of growth the shell is much more elongated, and this feature may have induced him to retain his specific name for the smaller shell which he described.

Formation and locality.—Mr. Conrad cites it from Haddonfield, N. J. The specimens in the State collection are from Holmdel, N. J., both localities being in the Lower Green Marls. Specimens borrowed from the collection of the Academy of Natural Sciences, Philadelphia, come to me without locality marks.

Camptonectes parvus, n. sp.

Plate VIII, Figs. 1 and 2.

Shell quite small, the only specimen observed measuring only about three-tenths of an inch in height. Outline subcircular and (the left valve) convex, moderately elevated on the umbo and somewhat regularly declining in convexity, toward the front; anterior auriculation proportionally large and vertically striated with lamellose striæ parallel to the anterior margin. Surface of the shell polished and marked with numerous interrupted impressed striæ, the spaces between the striæ being flattened and crossed by very faint lines of growth.

Only a single individual of this species has come under my observation. The shell presents the features in its external appearances of the Jurassic forms of the genus, as they occur at the west, and is the only individual from New Jersey that I have seen which possesses the peculiar impressed striæ so characteristic of those forms. It, however, wants the punctures that are present in the bottom of the striæ of those, and in this respect differs very materially. It also differs in its very small size and greater convexity. It is possible that it may not be an adult shell, but the character of the striæ is sufficient to distinguish it even should it be found of larger growth.

Formation and locality.—In a band of clayey marl of the Lower Bed, at Freehold, New Jersey.

Genus NEITHEA Drouet.

Neithea quinquecostata.

Plate VIII, Figs. 12-14.

Pecten quinquecostata (Sowerby). Morton, Synop., p. 57, Pl. XIX, Fig. 1.
Janira Mortoni (D'Orb.). Prodr., p. 253.
Neithea Mortoni (D'Orb.). Gabb, Synops., Cret. Form., p. 149. Meek, Check-list Smith. Inst., p. 7. Geol. Surv. N. Jers., 1868, p. 725.
Vola Mortoni (D'Orb.). Stoliczka, Pal. Indica, Vol. III, p. 430.
Pecten quinquecostatus and *P. quadricostatus* of authors.

Shell broadly ovate exclusive of the auriculations, and plano-convex to concavo-convex in profile, right valve strongly convex, with a sharp, arching, and incurved beak extending beyond and partially overarching the hinge-line; hinge-line straight or nearly so, slightly declining on the anterior side; nearly two-thirds as long as the entire width of the shell; auriculations moderate in size, the anterior one the smallest and constricted below where it joins the body of the shell, forming a slight byssal notch; posterior side triangular, longest at the hinge-line and receding below. Sides of the valve where it joins the auriculations strongly incurved laterally, so as to cause the sides to overhang. Valve marked by six strong, rounded, principal radiating costæ, with from two to four smaller ones between. These are usually distributed in the following manner: three between the two anterior strong ones; three or four between the two antero-basal and median ones; three usually between the postero-basal pair, and usually two only between the posterior pair. There are also three or four anterior to the first strong ray, and from four to six on the area posterior to the last principal ray. The auriculations are also rayed, unequally on the opposite sides, the posterior one most strongly. The characters of the flat or left valve have not been observed on the New Jersey specimens. The casts, the only condition in which I have seen them from within the State, show evidence of moderately strong concentric lines crossing the rays and intermediate portions of the shell.

The shell seems to be subject to considerable variation in the number and strength of the secondary costæ, and this fact has given great latitude to species-making, consequently we have several names under which the shell has been mentioned and referred to. Judging from what specimens I have examined, there appears to be but little reason for considering them other than as varieties of a single species, and our American forms differ so little from those found in Europe and Asia that I have been inclined to refer them back to the place where Dr Morton first placed them. The generic reference of the form seems to have passed through equally great tribulation as the species. I have left it under the genus which most writers of late date seem to prefer, as there is some doubt as to the exact value of the two older names *Vola* Klein, and *Janira* Schum.

Formation and locality.—In New Jersey it is found in the Lower Green Marls at Burlington, Holmdel, Freehold, and Mullica Hill. It is also found at Prairie Bluff, Ala., and at several places in Texas, and in England, Continental Europe, and at many places in Asia, being one of those almost universal forms which we occasionally find.

SPONDYLIDÆ.

Genus SPONDYLUS Lam.

Spondylus gregalis.

Plate IX, Figs. 11, 12, and Plate X, Figs. 1, 2.

Plagiostoma gregale Morton. Synop., p. 60, Pl. V, Fig. 6.
Spondylus gregalis (Mort.). Gabb, Synop., p. 171. Meek, Check-list Smith. Inst., p. 7. Geol. Rept. N. Jer., 1868, p. 724.
S. *gregalis* D'Orb. Prod., p. 254.

Shell rather above medium size when fully grown, and generally ovate in form, with the lower or attached valve somewhat the deepest. Cardinal area large, but short, much extended and flattened on the surface; transversely striated and with a narrow linear groove through the middle; teeth strong. Surface of the lower valve strongly lamellose on the free portions; the attachment apparently being only small and near the apex; between the lamella, which are elevated, the surface shows indistinct radiations, which on the interior are quite distinctly marked and flexuose, and are comparatively fine. The upper valve not observed, except as shown on casts of the interior. In this condition it is shown to have been only very moderately convex at the apical portions, and to have been flattened or but very slightly convex toward the front, with the surface radiated as in the case of the lower valve, but whether the exterior has been lamellose or only simply radiated I have not been able to ascertain.

The figure given of this species by Dr. Morton, as cited above, is nearly circular in outline. Among the few casts which I have seen and one perfect lower valve there is none of that form, all being elongate-ovate, narrow toward the beaks and widened below, and all slightly curved to one side. On the casts the muscular imprint as shown on the lower side is quite large and uniform, and situated rather below the middle of the valve.

The large entire valve of the species figured is neatly perforated through the solid part of its substance, showing the work of some boring mollusk.

Formation and locality.—In the Lower Green Marls at Upper Freehold, Monmouth County, N. J., collected by Dr. Bruere.

Genus DIANCHORA, Sowerby.

(Mineral Conch., Vol. I, p. 183.)

The genus *Dianchora* was described by Sowerby in 1815 (Min. Conch., Vol. 1, p. 183), for the reception of two forms of Spondylus-like shells, that appeared to be without hinge area or teeth. Subsequently the genera *Pedopsis* Sow. and *Pachytes* Desh. were proposed by their respective authors for similar forms. In later years all these genera, which appear to be synonyms of each other, have been condemned by many authors, under the impression that the shells on which they were founded were mutilated specimens of *Spondylus* that had by accident been deprived of these parts. It seems strange that naturalists are so often led to discredit the statements of good observers, and to reject their work simply because they themselves have not observed the same features. It is perhaps, however, well that such care be exercised to keep down names and divisions founded upon imperfections and abnormal features. But in this case the rejection has certainly been too hastily made, for the species here described certainly agrees in character perfectly with Sowerby's description and figures, especially of his *D. striata*, given in the Min. Conch., and it is equally certain that the shells are perfect and without injury; and the lines of growth clear, clean, and distinct as on any living shell. The triangular foramen extends from the beak forward to the position of the hinge-line, and laterally to the entire width of the shell at this point on both sides, leaving the entire cardinal portion of the shell forming a single broad triangular opening in each valve, while the margins are elevated and sharp, with the lines of growth passing over them in perfect continuity.. What the purposes of this opening may have been I cannot say. It is not the position for a byssus, or any organ of similar nature; nor can it have been needed for any analogous purpose, as the shells are all, so far as I have seen, firmly anchored or attached to foreign substances. The small specimen figured was attached only by the beak, but that by a surface nearly or quite a fourth of an inch wide. From the form of the apex of the upper valve, as far as I have seen them, I judge it curved over this opening in such a manner as to partially cover it, as they are all extremely ventricose in this part. But this was not the case in the English species, for there the upper valve is but moderately convex. So the question as to the purpose of the opening remains unsolved.

Dianchora echinata.

Plate X, Figs. 3-9.

Plagiostoma echinatum, Morton. Synopsis, additional observations, § iv.
Spondylus echinatum (Mort.) Meek, Check-list, p. 71. Geol. Surv. N. J., 1868, p. 724.
S. capax Conrad. J. A. N. S., Phil., 2d ser., Vol. II, p. 274, Pl. XXIV, Fig. 8.

Shell below medium size, subcircular or very broad-ovate in general outline, and with a very highly convex or gibbous free valve. Lower valve fixed to foreign substances, and often by nearly its entire surface, and conforming in depth to the surface to which it is affixed, or nearly so. Or when more concave the space between the margin of the shell and the object to which it is attached is filled up with shelly matter formed in the same manner as the spines of the valves. The cardinal portion of the valve is open, forming a broad triangular foramen the entire width of the valve at this point, the margins of the foramen being sharp, no hinge-teeth or cardinal area existing. The interior of the valve is strongly marked by moderately fine striæ or ribs, which are flattened on their surfaces; muscular imprints not observable. Upper valve very ventricose and strongly arcuate, the beak thin and sharply incurved. Hinge open as in the lower valve, the cardinal angles spread outward in the form of auriculations to meet those of the opposite valve. The sides of the valve are sharply bent inward on a line from the beak to the point of greatest width, forming a hiatus on each side between the body of the valve and the auriculation, as in the genus *Janira.* Surface of the valve marked by strong, closely compact, radiating ribs; every fifth or sixth one of which is stronger than the others, and bears short, sharp, curved spines, some of which are nearly one-fourth of an inch long, while the others are only rugose from the concentric lamella which cross them. On the depressed spaces on the sides of the valve there are no radii, the concentric lines only being present. Substance of the shell thin in the cardinal portions and much thickened toward the front. Interior of the valve marked by the radii, and the thickened front margin strongly crenulate.

A single highly decomposed specimen of Spondylus-like shell, in the collection of the Academy of Natural Sciences, Philadelphia, may possibly belong to this species, but its condition is such that its specific relations are not determinable, and in a short time more it will have crumbled. It shows no evidence of having been attached, however; the lower valve is moderately convex and the upper one rather more ventricose; the area or cardinal parts of both valves are beyond description, but the valves are both marked by rays and spines, as are the upper valves of this one. It may possibly represent an undescribed form, but looks like a specimen of the *D. echinata* that had been entirely free except perhaps in its earlier stages of growth.

Formation and locality.—In the Lower Green Marls at Holmdel, Freehold, and on Mr. Woodward's farm, Monmouth County, New Jersey. It does not seem to be abundant anywhere, and so far I have never seen a perfect upper valve of even medium size. The imperfect upper valve figured is from the collection of the Academy of Natural Sciences, Philadelphia, and is without locality further than "N. Jersey."

Genus PLICATULA Lam.

Plicatula urticosa.

Plate IX, Figs. 1 and 2.

Ostrea urticosa, Morton. Synop., 1st ed.
Plicatula urticosa, Morton. Synop., p. 62, Pl. X, Fig. 2. Am. Jour. Sci., Vol. XXIV, 1st ser., Pl. X, Fig. 2. Gabb, Synop., p. 169. Meek, Check-list, p. 7. Geol. Surv. N. J., 1868, p. 724. Stoliczka and others.

Shell irregularly oval in outline and obliquely curved, biconvex or plano-convex, marked by strong, somewhat angular radiating and bifurcating plications, usually much stronger and less numerous on the lower than on the upper valve, and crossed by strong projecting concentric lamella, which are elevated and often form thin, flat spines on the crest of the radiating plications of greater or less length, which give a very rough and spiney surface to the shell, resembling that of *Spondylus*. Muscular impression moderate; teeth not observed.

On some internal casts from Freehold the muscular scar is quite large, and, so far as can be judged, the teeth have been quite small. The shell appears to have been quite abundant, and to have grown in groups, attached to each other or to foreign bodies. On the Alabama specimens, and on some of those from New Jersey, there are indistinct radiating striæ between the plications. The largest individuals which I have observed are casts, one of which is one inch and five-eighths long and of a broadly-ovate form.

Formation and locality.—In the Lower Green Marls at Freehold and Holmdel, N. J. The type specimens of Dr. Morton in the collection of the Academy of Natural Sciences, Philadelphia, are without locality, being marked "Lower Cretaceous, N. Jersey" only.

Genus RADULA Klein.

Radula pelagica.

Plate IX, Figs. 3–5.

Plagiostoma pelagica Mort. Synop., p. 61, Pl. V, Fig. 2.
Ctenoides pelagica (Mort.) Gabb. Synop. Cret. Form., p. 114. Conrad, J. A. N. S., Vol. IV, p. 276.
Lima pelagica (Mort.) Meek. Check-list Smith. Inst., p. 7.
Radula pelagica (Mort.) Stoliczka. Palæont. Indica, Vol. III, p. 416.
R. pelagica (Mort.) Meek. Geol. Surv. N. J., 1868, p. 724.

Shell of small size, seldom measuring more than one and a half inches in its greatest length from beaks to base; very oblique, strongly ovate, moderately inflated and marked by from twenty-five to thirty strong, radiating plications, which are simple, rounded on the top, and separated by rounded spaces of equal width, and crossed by fine concentric lines of growth, which arch backwards in crossing them. Stronger concentric varices of growth also form a common feature of the shell. The hinge-line is straight and equal in length to about one-third the length of the shell from beak to base. Auriculations small and subequal; beak moderately curved and central to the hinge-line; area moderately high, with a very large central pit and the hinge destitute of teeth or other markings. Anterior or straight side not at all gaping.

As cited above, this species was originally described by Morton as a *Plagiostoma*, but owing to the great multiplication of genera has been referred to a different genus by every writer who has treated upon it. The shell as seen in the single valve figured on Plate IX, fig. 4, would fall between the genera *Radula* and *Ctenoides*, according to the characteristics of these genera as defined by Stoliczka, with a leaning toward the latter of the two, as the shell may be said to be absolutely straight on the anterior margin; and, so far as can be proved by the specimen and from several casts, must have been nearly, if not quite, without any gape of the valves. The two genera, however, are, as there defined, so nearly alike that they would seem hardly to afford specific differences so far as form, without surface markings and color, are concerned.

Formation and locality.—In the Lower Green Marls of the Cretaceous at Holmdel and Freehold, New Jersey.

Radula acutilineata.

Plate IX, Figs. 6 and 7.

Ctenoides acutilineata Conrad. J. A. N. S., Phila., 2d ser., Vol. III, p. 329, Pl. XXXIV, Fig. 2. Gabb, Synop., p. 114.
Lima acutilineata (Con.) Meek. Check-list, p. 7.
Radula acutilineata (Conrad) Meek. Geol. Rept. N. J., 1868, p. 724.

Shell small, obliquely ovate, and very ventricose; hinge-line very short, with small acute auriculations, especially the anterior one, which is pointed at the extremity. Anterior side of the shell rounded and full; posterior side straightened above and rounded below. Surface of the valves marked by about twenty to twenty-two narrow, elevated radii, with flattened spaces between, leaving the radii widely separated. Anterior and posterior slopes without radii.

This species is very like *R. reticulata* L. & F., but may be readily distinguished by the flattened or occasionally slightly concave spaces between the radii. In other respects the shells are very much alike.

Formation and locality.—In the Lower Marls at Haddonfield, New Jersey. The specimens used are from the collection of the Academy of Natural Sciences, Philadelphia.

Radula reticulata.

Plate IX, Figs. 8 and 9.

Lima reticulata Lyell and Forbes. Quart. Jour. Geol. Soc., Vol. I, p. 62, 1845, with figures. Meek, Check-list S. Inst., p. 7.
Ctenoides reticulata Gabb. Synop., p. 114.
Radula reticulata (L. and F.) Meek. Geol. Rept. N. J., 1868, p. 725. Stoliczka, Palæont. Indica, Vol. III, p. 416.
R. denticuticosta (Gabb) Conrad. Am. Jour. Conch., Vol. V, p. 99, Pl. IX, Fig. 17.
?*Ctenoides denticuticosta* Gabb. Proc. A. N. Sci., Phil., 1861, p. 327.

Shell small, moderately oblique, strongly ovate, and inflated. Hinge short; beaks proportionally strong, and projecting beyond the cardinal line. Valves nearly equal; anterior margin straight, and not at all gaping; auriculations small but distinct, rectangular or very slightly pointed at their outer angles. Surface radiately ribbed, those of the anterior and posterior slopes faintly marked or obsolete, ribs (about thirty) distinct, with five or more indistinct on each side; subangular on the middle of the valves and rounded toward the sides, crenulate or subspinose on the larger specimens when well preserved, but often appearing nearly smooth. Entire surface marked by concentric lines which give a roughened surface when perfect, giving the reticulated character indicated by the specific name.

The shells are all small, seldom exceeding three-fourths of an inch in length, and are very fragile. The right valve appears to be a little less ventricose and the beak shorter than the left in all the specimens which I have seen where the two are united, still this may be only apparent, as they are all somewhat displaced, and all those which I have seen free from the matrix and separated have the hinge imperfect, so that I have not examined the area or cartilage pit; and none of them exhibit the slightest evidence of a byssal sinus. The species differs from *R. pelagica*, Mort., in its smaller size, more inflated valves, and greater number of radii.

Formation and locality.—In the lower part of the Lower Green Marls at Upper Freehold, New Jersey. Collected by Dr. Bruere.

Suborder HETEROMYARIA.

MYTILIDÆ.

Genus MYTILUS Linn.

Mytilus oblivius, n. sp.

Plate XVII, Fig. 1.

Shell small, erect, or but very slightly curved on the buccal margin; beaks terminal, projecting and acute. Hinge line sloping at an angle of about sixty degrees to the buccal margin; posterior margin subparallel to the anterior, and the extremity rather sharply rounded. Anterior face abrupt, and the surface of the valve gradually sloping from the umbonal angle to the posterior margin. Surface apparently marked by fine lines of growth as indicated on the cast.

The species is known only from a single cast of a left valve, which so nearly resembles all other species of Mytilus that but little comparison can be instituted. It is more nearly like *M. condecoratus*, Conrad (Geol. Rept. N. Carolina, Kerr, Appendix, p. 5, Pl. I, Fig. 10), than any other Cretaceous form I know, but is decidedly longer in proportion to its width.

Formation and locality.—In the micaceous clay under the Lower Green Sand at the pits of the Rev. G. C. Schanck, near Marlborough, New Jersey. From Mr. Lockwood's collection.

Genus MODIOLA Lam.

Modiola Julia.

Plate XVII, Figs. 6 and 7?.

Modiola Julia Lea. Proc. A. N. Sci., 1861, p. 149. Meek, Check-list, p. 11.
Perna Julia (Lea). Meek, Geol. Surv. N. J., 1868, p. 726.

Shell rather small, measuring only about nine-sixteenths of an inch in its greatest length, which is about twice the height. Form elongate-ovate, the cardinal and basal margins being nearly parallel and the ends nearly equally rounded. Valves ventricose, most gibbous at the anterior end; beaks inflated but not prominent, nearly but not quite terminal, but placed on a line with the hinge, or nearly so. Hinge extending about two-thirds the length of the shell and rounding into the posterior end, which is longer below than above the middle. Surface of the shell polished, but with very strong concentric undulations parallel to the margin. Hinge and features of the interior unknown. Substance of the shell extremely thin.

I do not think the shell is a true *Modiola*, but the specimens examined, two only, are not in a condition to reveal any of the generic features, both being crushed and badly broken, and by far too thin and fragile in substance to possess them in any degree of strength. I have referred it back to *Modiola* Lamarck, not thinking it advisable to replace that name by the pre-Linnean one adopted by Mr. Meek in his list, or by the later one of *Volsella*.

Formation and locality.—In the micaceous clays of the Lower Green Marls, at Haddonfield, New Jersey. From the collection of the Academy of Natural Sciences, Philadelphia.

Modiola Burlingtonensis, n. sp.

Plate XVII, Figs. 8 and 9.

Shell of moderately large size, very ventricose, and with subparallel dorsal and ventral margins, large prominent umbones and incurved beaks situated near the anterior end but not terminal, the anterior margin perceptibly extending beyond them and rounded. Umbonal ridge prominent and subangular, especially near the beaks, and becoming broader and more rounded posteriorly; surface of the valves strongly constricted and sinuate in front of the ridge and the anterior surface again inflated; cardinal slope comparatively broad and slightly concave toward the postero-cardinal border. Hinge line straight and three-fifths as long as the shell, and rather strongly impressed in the internal cast; postero-cardinal margin rounding rapidly forward from the more narrowly rounded posterior extremity. Surface of the cast, the only condition under which it is known, apparently smooth or marked only by irregular concentric lines of growth, some of which produce undulations of considerable strength on the casts. On one individual there appears on the posterior cardinal slope very faint indications of rather coarse radiating lines, but too faint to warrant the statement that such markings really existed on the shell.

These specimens were found in the collection of the Academy of Natural Sciences, Philadelphia, marked "*M. ovata* Gabb," and also marked "types," but as they are totally distinct from the specimen figured as the type by that author, and which is also now before me, I can only interpret the error to some wrong identification at some subsequent time. The species differs from *M. ovata* in its much greater size, more cylindrical as well as more elongated form, prominently subangular umbones and umbonal ridge, strongly sulcated surface, and much broader anterior end. There is no Cretaceous species known with which there is danger of confounding it.

Formation and locality.—In the ferruginous clay beds of the Cretaceous in Burlington County, New Jersey, the special locality not mentioned, but marked on the label as "middle beds," which I am led to believe incorrect from the fact of the lithological features of the specimens being exactly similar to so many fossils from this same neighborhood which are credited to the Lower Marls.

Genus LITHODOMUS Cuvier.

There is a question among authors as to which of the two names should be used. *Lithodomus* Cuv. or *Lithophagus* Bolt. The fact that the latter is only a repetition of the specific name of the generic type is a great objection, for which reason I have adopted the former.

Lithodomus affinis.

Plate XVII, Figs. 2 and 3.

Lithophagus affinis Gabb. Proc. A. N. Sci., Phil., 1861, p. 124. Meek, Check-list, p. 11. Geol. Surv. N. J., 1868, p. 726.
L. *Ripleyanus* Gabb. Proc. A. N. S., Phil, 1876, p. 311.

Mr. Gabb described this species from the tubes, or as I suppose the filling of the tubes, and states that he had not seen the shell. In the collection of the Academy of Natural Sciences, Philadelphia, there is an internal cast of a shell, somewhat imperfect at the posterior end, which is marked with ink on the specimen "*L. affinis* type," which I suppose to have been the one he used in his description. The form is extremely ventricose, especially on the anterior half, and narrowing rapidly posteriorly, with the posterior part strongly curved downward as far as preserved. The following is Mr. Gabb's description as copied from the work cited above. "Tube robust, curved short, portion containing the shell broad, grooved at the anterior half of the back, rounded carinate the rest of the length. Opposite face more narrow and deeply grooved. Extremity distinctly trilobate. Shell unknown. From the shape of the tube it appears related to the preceding species (*L. Repleyanus*), but the beak is less prominent in advance, the shell is much more gibbous, the basal margin more emarginate, and the posterior cardinal margin more depressed." The specimen above referred to, which is that figured on the plate, corresponds exactly with his description of its dimensions and in other particulars, but I should consider it a representative of the shell rather than of the tube only.

Formation and locality.—The specimen was from the Lower Green Marls of New Jersey, but the exact locality is not known. Mr. Gabb thought it probably from Burlington County, and it is the only specimen of the form known.

Lithodomus Ripleyana.

Plate XVII, Figs. 4 and 5.

Lithophagus Ripleyana Gabb. Proc. A. N. Sci., Phil., 1861, p. 124. Meek, Check-list, p. 11. Geol. Sur. N. J., 1868, p. 726.
L. *affinis* Gabb. Proc. A. N. S., Phil., 1876, p. 311.

Shell small, length probably not exceeding three-fourths of an inch, very ventricose anteriorly when viewed from the dorsal side, but with nearly parallel dorsal and ventral margins as seen in a side view. Beaks anterior or nearly terminal, incurved and somewhat tumid, as seen in the cast, posterior extremity of the shell compressed. Dorsal margin impressed and the ligament extending nearly one-half the length of the shell. Shell structure unknown, the specimens all being internal casts.

This species is much more slender and less inflated anteriorly, as seen in the internal casts extracted from within the burrows, than *L. affinis*. The posterior end seems to have been commonly prolonged and curved downward very decidedly near the extremity, and also to have been sharply pointed in some individuals. There is a considerable degree of variation among the individuals, both in the form and in the proportional length of the tubes, some of the casts being cylindrical and others flattened laterally on the posterior half. They appear to have burrowed in wood or in other substances indiscriminately, many of them showing unmistakable evidences of a woody structure on the outside of the cast of the tube; while one colony which I have seen had burrowed into the shell of *Gervilliopsis ensiformis.*

Formation and locality.—In the Lower Green Marls near New Egypt, and at Mr. Ware's pits near Mullica Hill; and at Hunt's pits at Manalapan, Monmouth County, New Jersey. There are several individuals in the collection of the Academy of Natural Sciences, Philadelphia, which would appear to have come from several other localities, but they are only marked "N. J.," no more definite locality being known.

PTERIIDÆ Meek (=*Aviculidæ* of Authors).

Genus PTERIA Scopoli.

Pteria petrosa.

Plate XIV, Fig. 10.

Avicula petrosa Conrad. Jour. A. N. S., Phil., 2d ser., Vol. II, p. 274, Pl. XXIV, Fig. 15. Gabb, Synopsis, p. 102.
Pteria petrosa (Con.). Meek, Check-list Smith. Inst., p. 9.
Comp. *Avicula laripes* Morton. Synop. Cret. N. Am., p. 63, Pl. XVII, Fig. 5.

Shell of moderate size, obliquely ovate, unequivalve, very inequilateral, and moderately ventricose; hinge-line straight, its entire length being unknown, and so far as can be determined from the imperfect casts examined has not been extended in form of a wing posteriorly. Anterior wing of considerable size and separated from the body of the shell by a deep constriction, most distinct on the right valve, and protruding beyond the beaks of the shell anteriorly. Surface of the cast of the right valve preserving indications of a few distant radii along the umbonal slope, but none are visible on the left valve, probably owing to the greater thickness of the shell not transmitting them to the interior surface.

I strongly suspect this to be identical with *Avicula laripes* Morton, which was from the Cretaceous marls of Delaware, but of which I have not seen specimens. The shell is somewhat more oblique than Morton's figure, and it does not appear to have been extended into the wing-like projection indicated by him. The radii have about the same distance and direction, as far as can be determined from the poorly-preserved cast used, but are not distinct enough to count, so I cannot be certain of its identity. From *Pteria linguiformis* E. & Shum., found in the Cretaceous beds of the West and in Texas, it differs in being more oblique and more transverse, with a less width of the body of the shell, and the beaks do not appear to have been so strongly elevated above the hinge, and consequently the ligamental area is much narrower.

Formation and locality.—The only specimen of the species which I have yet seen is from the ironstone nodules found in the lower clays of the Cretaceous, at or near Keyport, N. J., and is from the collection of Columbia College, New York.

Pteria laripes.

Plate XIV, Fig. 9.

Avicula laripes Morton. Synopsis p. 63, Pl. XVII, Fig. 5. Gabb.
Pteria laripes (Mort.). Meek, Check-list, p. 9.

Shell of but moderate size, oblique ovate and moderately convex, with rather prominent beaks. Hinge less than half the length of the body of the shell, forming on the posterior side a proportionally large wing, which is obtusely pointed at the extremity and only shallowly sinuate on the outer margin between the hinge line and body of the shell. Anterior wing unknown. Surface of the shell, on the left valve, strongly marked by distant elevated radii, which seem to have been alternately coarse and fine on the posterior half of the valve, judging from the only cast examined, and equal in strength and moderately curved forward on the anterior half; while the margin of the valve seems to have been marked by strongly projecting points corresponding to the ribs.

The specimen used in the above description is so nearly like Dr. Morton's figure that were it not a left instead of a right valve I should have supposed it to be the same individual. The specimen is a cast in rather hard sandstone, rather unlike any other fossil which I have seen from New Jersey, but is distinctly marked "N. J." in the collection of the Academy of Natural Sciences, Philadelphia, in what I take to be Mr. Conrad's writing; while it is also marked "type." I am inclined to infer from the above facts, and the close resemblance it bears to Dr. Morton's figure, that the specimen is Morton's type, and that it came from Delaware rather than New Jersey; also that the figure in the "synopsis" has been reversed by the lithographer, making a right valve with the characters pertaining to a left valve in this way. The shell is so unlike any other known New Jersey species that there can be no difficulty in recognizing it. I am somewhat inclined to think the species belongs to the group to which Mr. Meek applied the generic name *Oxytoma*, but in the absence, or rather imperfection of the anterior part of the hinge line, I am not positive.

Formation and locality.—Probably from Delaware, although distinctly marked on the label "N. J." in the collection of the Academy of Natural Sciences, Philadelphia. The position in the series not determined.

Pteria navicula, n. s.

Plate XIV, Fig. 8.

Shell of small size, the greatest length being less than half an inch; very oblique and angularly ventricose, the height scarcely more than half the length. Hinge line nearly as long as the body of the shell, mucronate and slightly prolonged at the posterior extremity, which is separated from the body of the shell by a slight sinuosity. Anterior wing, if any, not preserved on the specimen; but the shell, although somewhat imperfect, does not appear to have been winged on the anterior side. Posterior extremity of the body of the (left) valve obtusely pointed, and the anterior end narrowly rounded from the extremity of the cardinal line. Basal line broadly curved, gradually descending from the anterior end to about the posterior third of the length, where it again rises to the extremity. Beaks small, rising a little above the hinge line, and prominently ventricose. Surface of the shell marked only by concentric striæ, so far as can be determined from the partially exfoliated individual. Right valve unknown.

There is only a single left valve of the species known so far, but the form is so decided that there is no possibility of confounding it with any described species. The extremely ventricose form of the body of the valve and angular umbonal ridge at once distinguishes it from any known form.

Formation and locality.—In the dark micaceous clays below the Lower Marls at Haddonfield, N. J. From the collection of the Academy of Natural Sciences, Philadelphia.

MELEAGRINELLA, n. gen.

Shell aviculoid having the general form of MELEAGRINA. Lam. (=*Margaritophora* Megerl.) but differing principally in the form of the byssal fold of the right valve, which is either a deep channel on the external surface of the shell extending from the margin to near the beak of the valve or a simple deep straight notch separating the wing into a linear process, of greater or less length, from the body of the shell. Shells biconvex; hinge straight; ligamental area narrow, but distinct, strongest on the left valve, which is also the most convex, and more or less gaping opposite the notch of the right valve. A single muscular scar of large size occurs subcentrally behind the middle of the valves; other muscular scars unknown. Surface lamellose or lamellose-radiate, with a fine radiate fibrous glistening texture like that of *Placumomya*. Types *M. curta* (=*Avicula curta* Hall) and *M. orbiculata*=*Pseudomonotis* (*Eumicrotis*) *orbiculata* Whitf. Black Hills Rept., p. 356, Pl. III, Figs. 17–19.

This genus is more nearly related to *Meleagrina* Lamarck than to any other described form. In the Palæont. of the Black Hills I referred the two typical species to *Eumicrotis*, Meek, which he considered as a division of *Pseudomonotis*, Brown, following Mr. Meek's own reference in so doing, with the remark that it might take the name *Eumicrotis*, providing the Permo-carboniferous forms on which that genus was founded, should be found not to conform too nearly to Brown's genus *Pseudomonotis*, but as I suppose this would not be admissible, I have thought it more proper to propose a new genus for it. Dr. F. Stoliczka, in his discussions of the *Aviculidæ* in vol. iii, Pal. Indica, considers *Eumicrotis* and *Pseudomonotis* as synonymous; but certainly our American Permo-Carboniferous forms referred to *Eumicrotis* are very distinct from the forms referred originally to Brown's genus.

The following species which we have referred to this new genus is less strongly marked in its generic features than the types, but is sufficiently strongly marked when seen in good specimens of even small size to be at once separable from either *Avicula* on the one hand or *Melegrina* on the other, and if we must take the features of the typical species of *Oxytoma* as the standard, it certainly cannot belong to that genus, as Meek suggests it probably is, in his Invert. Pal. U. S. Geol. Surv. Territ., page 35.

Meleagrinella abrupta.

Plate XIV, Figs. 11–14.

Avicula abrupta Con. J. A. N. Sci., Phil., Vol. II, 2d ser., Vol. II, p. 274, Pl. IV, Figs. 5 and 6.

Shell small, inequivalve, rhombo-quadrate in outline, the hinge-line long and straight, reaching nearly the entire length of the shell, beaks small, situated at about the anterior third or fourth of the length of the hinge; that of the left valve rising a little above the cardinal line, and that of the right just to its margin. Right valve with a deep notch-like slit on the anterior side just below the hinge, with a narrow, deep groove running from it to the apex of the valve on the exterior surface. Left valve provided with an internal fold, quite indistinct except under a glass, on the anterior side of the beak, which corresponds to the byssal notch of the right valve. Anterior margin of the valve somewhat regularly rounded; basal margin broadly rounded, and the posterior obliquely truncate, passing backward slightly from the hinge extremity to the postero-basal line. Surface of the valves smooth or very finely lamellose, and marked with concentric undulæ. When not at all worn or macerated the surface of the left valve shows indistinct thread-like, interrupted, radiating lines which remind one very strongly of those seen on species of *Placunomya.*

In Mr. Conrad's original description of this shell he refers it to *Avicula,* but in general appearance it resembles more nearly the common pearl oysters *Meleagrina.* On more critical examination it is seen to possess the features of the Jurassic shells *Eumicrotis curta,* and *E. orbiculata,* which I have made the types of a new genus, *Meleagrinella,* on account of the peculiar features of the byssal notch, in which they differ from *Meleagrina,* although more nearly related to that than to those of any other established genus.

Mr. Meek has referred to this shell on page 35, in his Invert. Pal. U. S. Geol. Surv. Territ., where he speaks of it as being evidently an *Oxytoma*, a genus founded on a Jurassic shell of very different characters from this one. (See *Oxytoma mucronata*, Pal. Black Hills, p. 357, pl. iv, figs. 1 and 2, which is the species on which the genus *Oxytoma* was founded.)

Formation and locality.—In the Lower Green Marls of the Cretaceous at Freehold, New Jersey. The specimens were collected and kindly loaned for use by Miss F. M. Hitchcock, of New York City.

GERVILLIOPSIS, n. g.

Shell bivalve, resembling *Gervillia* in form, but with the anterior end squarely truncate and the beaks terminal. Hinge with a broad ligamental area, crossed on the posterior side by vertical cartilage pits and fine, oblique corrugations instead of teeth. Area continued down the anterior truncation as in *Myalina*, but deeply and abruptly excavated, forming a gaping anterior end. A large ovate muscular scar occurs, subcentrally situated, just within the extremity of the hinge, and a smaller double one obliquely placed between it and the anterior end. Small scars also occur beneath the hinge Shell pearly and iridescent.

This genus of shells differs from *Gervillia*, under which it has heretofore been classed, in the absence of the teeth on the posterior portion of the hinge, and the oblique tooth-like ridges below the ligamental area on the posterior end. It also differs in the truncation of the anterior end or wing; in the continuation of the ligamental or striated area-like surface along the anterior truncation, and in the gaping of the valves anteriorly. In the last two features it appears to combine features of the genus *Myalina* while in general form and in the ligamental area and cartilage pits of the posterior hinge it resembles *Gervillia*. Type *Gervillia ensiformis* Conrad.

Geological position.—As yet known only by two species, from the lower bed of the Lower Green Marls of the Cretaceous of New Jersey.

Gervilliopis ensiformis.

Plate XV, Figs. 8-11, and Plate XVI, Fig. 5.

Gervillia ensiformis Conrad. Jour. A. N. Sci., Vol. III, p. 328, Pl. XXXIX, Fig. 10.

Shell of moderately large size and thickened, falciform, very oblique; the body of the shell finally becoming parallel to the hinge or even slightly recurved, narrowing posteriorly and flattened on the surface. Hinge-line straight, short, not more than one-fourth the length of the shell in grown individuals; posterior wing only moderately elevated, and the posterior margin rapidly sloping backward from its extremity to the body of the shell, anterior wing very slight, the anterior end of the shell being squarely truncate at right angles to the hinge. Beak of the shell small and terminal, elevated above the wing and continuing in a ridge to the surface of the valve. Greatest width of the shell opposite the posterior extremity of the hinge. Surface of the shell lamellose, and marked by numerous concentric varices of growth, and on the basal portion of the right valve indications of fine radiating lines occur. Hinge area moderately wide, marked by several transverse ligamental pits, arranged at a little more than one-fourth of an inch apart, and also by numerous oblique corrugations. Muscular imprints large and obliquely situated. Substance of the shell highly nacreous throughout and iridescent.

This species was originally described from Tippah County, Mississippi, but has been recognized by its author and others as occurring in the Cretaceous strata of New Jersey.

Formation and locality.—The only examples of the species which I have seen are from the marls of the lower beds at Woodbury, Gloucester County, New Jersey, and appear to be quite abundant, but usually in a very fragmentary condition. Mr. Conrad's specimens were from Tippah County, Mississippi.

Gervilliopsis minima, n. sp.

Plate XV, Fig. 7.

Shell small, the only specimen observed, a cast, measuring only a trifle over one inch in length, and less than three-eighths of an inch in its greatest width. Shell elongate-elliptical, extremely oblique, slightly curved, and the valves very ventricose. The beaks, as shown on the cast, have been pointed, the area wide, and the anterior hiatus has been proportionally large and distinct. The muscular scars are very distinct and well marked.

The cast is a miniture of *G. ensiformis*, except in its greater ventricosity, and were it not for that feature would very naturally be taken for a young individual of that species. All the small shells which I have seen of that one, however, have been remarkably flat, and present an extremely shallow cavity, as in fact do the largest shells, while this one, although so very small, is almost half as thick as high, which is a remarkable difference for shells of this character. Besides, the entire features as presented by this cast, are those of a perfectly formed adult individual.

Formation and locality.—In the Lower Green Marls at Freehold, New Jersey.

Genus INOCERAMUS Sowerby.

Inoceramus Barabini.

Plate XV, Figs. 3-5.

Inoceramus Barabini Morton ?. Synopsis, p. 62.
I. *Cripsii*, var. *Barabini* (Mort.). Meek, Invert. Pal. Geol. Surv. Territ., p. —, Pl. XII, Fig. 3.
I. *Barabini* (Mort.). Whitf., Pal. Black Hills of Dakota, p. 398, Pl. VII, Fig. 7, and Pl. IX, Fig. 8.
Not *Inoceramus barabini* of authors generally.

Shell of only moderate size, transversely ovate or elliptical, with moderately to prominently convex valves. Beaks large, only slightly projecting beyond the line of the hinge, and situated near the anterior end. Hinge-line two-thirds as long as the shell, and rapidly rounding at the posterior extremity into the posterior margin, which is more broadly rounded than the anterior extremity. Basal line gently and somewhat gradually arcuate, but more rapidly curving upward near the anterior part. Surface of the shell marked by regular concentric, rounded undulations parallel to the margin of the valve, and separated by concave interspaces. Near the outer limits of the valve the undulations become more irregular, as if taking on old-age characters.

The specimen used in the above description is an imperfect cast of a right valve. The undulations are somewhat narrower than are those on specimens recognized as of this species from the Upper Missouri and Black Hills regions, but the general form of the shell is nearly the same, except, perhaps, in being a little less gibbous and a little higher, perhaps the result of flattening. In the narrower undulations it resembles Dr. Toumey's specimens of *I. proximus*, but the valves are too ventricose for that species and the outline not nearly as circular. There may be some doubt as to the propriety of recognizing this shell as identical with Dr. Morton's *I. Barabini*, principally on account of the gibbosity of the valves, as Dr. M. says in his description "not ventricose." It is generally considered that his shell was of this form, but Mr. Meek has shown that his figures may be very erroneous; and, as I have not been able to find Dr. M.'s type specimens, I am unable to judge how accurate Mr. Meek's restoration may be. Another individual, more lately obtained, more perfect than the first, shows the undulations narrower than any southern species which I have seen, but the resemblance to *I. Barabini* is too near to allow it to be considered as distinct.

Formation and locality.—In the Lower Green Marls at Holmdel, N. J. From the collection at Rutgers College, New Brunswick, N. J. Another specimen, more lately obtained from Marlborough, by Mr. D'Morgan, of New York, has been presented to the American Museum of Natural History.

Inoceramus Sagensis.

Plate XIV, Fig. 15, and Plate XV, Figs. 1 and 2.

Inoceramus Sagensis Owen. Geol. Rept. Iowa, Wis., and Minn., p. 583, Pl. VII, Fig. 3. Gabb, Synop. Cret. Form., p. 129.
I. Sagensis, var. *Nebrascensis* (Owen) Meek. Invert. Pal. Geol. Surv. Territ., Vol. IX, p. 52.
I. Nebrascensis Owen. Geol. Rept. Iowa, Wis., and Minn., p. 582, Pl. VIII, Fig. 1.
I. Sagensis (Owen) Whitf. Geol. Black Hills, p. 393, Pl. VII, Fig. 12.
Comp. *Inoceramus convexus* H. & M. Mem. Am. A. A. and Sci., new series, Vol. V, p. 386, Pl. II.
Comp. *Inoceramus convexus* Meek. Invert. Pal. Geol. Surv. Territ., Pl. XII, Fig. 5.
Inoceramus Balchi M. & H. Proc. A. N. S., Phil., Vol. XII, p. 180. Also Meek, Invert. Pal. Geol. Surv. Territ., Pl. XV, Fig. 1.
Comp. also *I. Vanuxemi* and *I. proximus* Meek, *I. proximus*, var. *circu'aris* Meek, and *I. confertim-annulatus* Roemer.

Several imperfect casts of Inocerami from different New Jersey localities are before me, all of which, with one exception, are much more nearly allied to *I. Sagensis* Owen than to *I Barabini* of Morton. The original form of them has been more or less circular in outline, with a comparatively long and straight hinge-line and moderately convex valves. The beak is only moderately elevated above the hinge-line, and in some cases, especially of the right valve, can scarcely be said to project beyond it.

The anterior end is obliquely prolonged beyond the line of the beak, and the remainder of the general outline, according to the concentric undulations of the surface, has been nearly circular or obliquely ovate, the greatest prolongation being in the line of the apex and of the postero-basal angle. The surface of one specimen from Holmdel (figured) is marked by strong, distant, rounded undulations parallel to the apparent lines of growth. The surface of this cast is marked by radiating lines of pustules, much elongated, forming interrupted lines or radii, exactly as is common to internal casts of *I. Sagensis* and other forms of *Inocerami* from the impure limestones of the Black Hills of Dakota. (No. 4 of the Missouri Section, M. and H) Another individual, much imperfect but retaining parts of both valves, from Freehold, N. J, indicates a circular form, with less convex valves, the left side being the most convex and having the beak much larger than on the right valve, as well as projecting much farther above the hinge-line. This specimen has the surface undulations much smaller and also much more numerous than the Holmdel specimen above referred to, there being three at least in the same space occupied by two on that one. In an iron nodule from Keyport, N. J., obtained from the brick clays of that place, there are the remains of several large individuals, imperfect and variously distorted, but still perfect enough to give their true form and characters These have also been circular in general outline, with moderately convex valves, but the undulations are remarkably large and prominent, round on the surface and in the depressions (some of them half an inch in width), and their surfaces have been marked by moderately strong concentric lines of growth All these variations are precisely like those observed in collections of the species from the typical western locality of *I. Sagensis* Owen, and may be seen in any collection of twenty individuals made at random from that region. The form from Freehold, N. J., with close undulations and compressed valves, is most nearly allied to the form usually referred to *I. Vanuxemi* Toumey, and might well represent that species, while all the others would be properly classed as *I. Sagensis*.

The New Jersey forms of the genus have, I think, been pretty uniformly referred to *I. Barabini* Morton, and generally without the least question as to the accuracy of the reference. None of Morton's specimens, however, were from New Jersey, but from Alabama. Mr. F. B. Meek has clearly shown in his Invert. Pal. Geol. Surv. Territ., p. 50, that Morton's figures, given in the Synopsis (Pl. XIII, p. 11, and Pl. XVII, Fig. 3), cannot be depended on as conveying any idea of the true form of the specimens used, and if one will examine Mr. Meek's figures there given they will easily be convinced that even there a very different outline may, with equal propriety, be drawn to his fig. 1, so as to make the figure much more circular in outline. For some reason it seems to have been considered that *I. Barabini* was a transversely elongated shell, having considerable convexity; and that the circular, discoid forms belonged to different species. This may be the fact, but I have never seen such a shell from Alabama, though they do occur in Texas and in New Jersey, and possibly may in Alabama. These circular and moderately convex forms, with broad, strong undulations, certainly cannot be considered as distinct from *I. Sagensis*, and the flattened form with more numerous concentric undulations are certainly allied to *I. Vanuxemi*, while the flattened form with strong undulations would appear to unite the two. In the Pal. Black Hills, I have considered the two forms as probably distinct, though I had considerable doubt in my own mind; and I am still more in doubt at the present time after examining specimens from New Jersey, from South Carolina, from Eufaula, Ala., and from Texas. Among those from the first three localities, I find the flattened forms with numerous undulations most common, and the more convex form resembling *I. Sagensis* quite rare, while at the West the reverse is usually the case. Probably local influences have been at work.

Formation and locality.—The convex form referred to above is from the white limestone layer at Holmdel, N. J., Lower Marl Beds. I have also seen a small individual of similar character marked as coming from near New Egypt, probably from the Lower Marl Beds near that town. The form resembling *I. Vanuxemi* is from Freehold, N. J., and the coarsely undulated flattened form and the more convex one are together in an iron nodule from Keyport, N. J., in the lower clays of the Cretaceous at that place. The latter specimen is in the cabinet of the School of Mines, New York; the others from the college collection at New Brunswick, New Jersey.

Inoceramus Sagensis, var. quadrans.

Plate XIV, Fig. 16.

Among the collections of the Academy of Natural Sciences, Philadelphia, from near Burlington, N. J., there is a large cast of an Inoceramus possessing many of the features of *I. Sagensis* Owen, but differing in the form, being quadrangular instead of circular, or very broadly ovate like that one. This quadrangular feature is so marked, and so distinctly one pertaining to the habit of the shell, that it seems like doing violence to one's ideas of specific distinction to class it under the head of any described form. In size and in the strength and distance of the undulations of the surface, as well as in its general convexity, it corresponds very well to most specimens of *I. Sagensis*, but the direction of the undulations indicate that the cardinal and basal margins have been subparallel, or gently diverging backward or to the umbonal ridge. The anterior end is almost squarely truncate, a little longer at the hinge than below, and the whole anterior slope from the beak to the margin of the valve is very abrupt and strongly ridged; the posterior end is prolonged and rounded below the middle of the shell, and obliquely truncate above to the extremity of the hinge, giving to the whole outline a somewhat rhombic character. The beak is very large and prominent, somewhat more so than is common in *I. Sagensis*, and very ventricose, while the whole valve is marked by strong, distant, although irregular, undulations, which become less marked and often duplicate on the posterior cardinal slope. The middle of the cast for about two-thirds the width is marked by strong, rather deep pits, connected by shallow furrows, showing that the interior of the shell was covered by strong pearl-like protuberances, which progressed with the growth of the shell as does a muscular scar, and I presume they were connected in some way with the vascular system as were the lines of dots or interrupted striæ on other species of the genus This is the only specimen which I have seen from either New Jersey or elsewhere possessing the peculiar quadrangular outline, but I presume if the locality were more thoroughly examined or carefully watched others would be obtained.

Inoceramus perovalis.

Plate XV, Fig. 6.

Inoceramus perovalis Conrad. J. A. N. S., Phil., 2d ser., Vol. II, p. 299, Pl. XXVII, Fig. 7. Proc. Acad. Nat. Sci., 1852, p. 200. Gabb. Synop., p. 129. Meek, Check-list, p. 10. Geol Surv. N. J., 1868, p. 726.

Shell small, almost regularly oval, the width and height being nearly as six and seven. Valves nearly equally convex, the right side perhaps a very trifle more convex than the left. Hinge-line comparatively long when the oval form is considered, being about three-fifths as long as the greatest width of the shell and oblique to the axis of the valve. Beak of the right valve sharp, projecting much beyond the line of the hinge, giving a proportionally broad or high hinge area, and on the cast, which is the condition of the type specimen, shows the single strong ligamental depression opposite the apex Surface of the shell, as indicated on the cast, marked by proportionally distinct concentric lines parallel to the margin of the valves.

In form this species is very distinct from any other described, and cannot well be confounded with them; the obliquely oval form, only a little deflected from an erect position, is also quite distinctive. The only individual known is the type specimen figured by Mr. Conrad, as above cited, and is entirely a cast with the left valve imperfect. In size, it is less than one inch and three-eighths in height, measuring along the axis of the valve, by a little more than one inch and one-eighth in width. The remarkable height of the hinge area and the impression of a single ligamental pit is somewhat peculiar, and gives one some doubt as to its true affinities with the ordinary forms of *Inoceramus*.

Formation and locality.—Mr. Conrad states in his description that the species is from the Chesapeake and Delaware Canal, crediting it to Mr. Vanuxem. The specimen is borrowed from the collection of the Academy of Natural Sciences, Philadelphia, for this work, and is labeled, apparently in Mr. Conrad's own handwriting, "New Jersey."

Inoceramus pro-obliquus, n. sp.

Plate XIV, Fig. 17.

Shell somewhat below the medium size for the genus; subovate in outline, the axis of the shell being directed forward of a right angle to the hinge-line, instead of backward as is usual with nearly all shells. Hinge-line shorter than the width of the body of the shell and forming an angle of about 110° to the axis of the valve. Left valve, the only one known, extremely ventricose, with a rather small beak, which is but little elevated above the line of the hinge, and situated in advance of the anterior margin of the valve. Height of the valve a little greater than its extreme width or length. Surface of the cast marked by numerous, regularly increasing concentric undulations, which are moderately sharp on the crests and the interspaces broadly concave. There are also indications of radiating lines along the middle of the valve, as in many species of the genus.

The species differs from any hitherto described American species of the genus, in having the axis of the shell directed forward of a right angle to the hinge instead of backward. In the general outline it somewhat resembles *I. perplexus* (Whitf., Pal. Black Hills of Dakota, p. 392, Pl. X, Figs. 4 and 5), but differs in the great convexity of the valve, greater forward obliquity of the axis, and stronger as well as more regularly undulated surface. It resembles in convexity and in the direction and position of the beak *I. altus* Meek and Hayden (Invert. Pal. Territories, pl. xiv, fig. 1), but differs entirely in the direction of the obliquity or of the axis of the valves.

Formation and locality.—In very dark friable, but coarse marl of the Lower Beds, at Holmdel, New Jersey, from a collection by the Rev. Dr. Riley.

PINNIDÆ.

Genus PINNA Linn.

Pinna laqueata.

Plate XVI, Figs. 1 and 2.

P. laqueata Conrad. J. A. N. Sci., 2d ser., Vol. III, p. 328. Gabb, Syn., p. 166. Meek, Check-list, p. 9. Geol. Surv. N. J., 1868, p. 725.

Shell of moderate size, very rapidly expanding from the apex and ventricose, giving a subquadrangular section. Surface marked by from nine to eleven strong, simple, radiating ribs on the dorsal portion, which are broad and rounded on the top and separated by very broad concave interspaces. The lower or basal portion is marked by very strong concentric striæ parallel to the margin, so very irregular as to often form strong undulations of the surface. Line of division between the upper and lower sections of the valves very strongly marked on the cast, often presenting the appearance of a distinct suture. Posterior margin of the shell apparently double, being deeply emarginate or lobed at the line of division between the upper and lower portions of the valve. The margin of the upper division is obliquely truncate, receding from below to the hinge-line, and strongly curved inward at the central emargination. Lower section also strongly lobed and somewhat rounded.

All the specimens seen are quite imperfect, and are more or less casts of the interior. The strong line of division between the upper and lower sections of the valve gives one the impression of a double shell, or of two distinct shells united along the margins; and were it not for the surface markings they would greatly resemble in form that of a large *Conularia.* This species is very closely allied in form and surface markings to *P. quadrangularis* Goldf. (Petref., p. 157, vol. ii, pl. 127, fig. 7), from the Cretaceous sandstones of Westphalia and Saxony, and in the Academy of Natural Sciences collection is so marked by I. Lea, Esq., on the label; but it differs very materially in its much greater degree of expansion toward the front of the shell.

Formation and locality—One large individual cast is from the coarse marls at Burlington, N. J., and there are several imperfect specimens, partially retaining the shell, from the fine micaceous clay below the Lower Marls at Haddonfield, New Jersey.

Suborder DIMYARIA.

ARCIDÆ.

Genus ARCA Linn.

Arca altirostris.

Plate XII, Figs. 22 and 23.

Arca altirostris Gabb. Proc. A. N. Sci., Phil., 1861, p. 325. Synopsis, p. —. Meek, Check-list, p. —. Geol. Surv. N. J., 1868, p. 725.

Shell small, transverse in the cast, with very much elevated and distant beaks, which are situated a little nearset to the anterior end. Valves extremely ventricose and about one-fourth longer than high. Area very wide and apparently three-fourths as long as the body of the shell. Anterior end abruptly rounded backward from the extremity of the hinge, and the posterior end obliquely truncated, being longest at the postero-basal angle, which is somewhat rounded. Basal line very gently arcuate, but not at all sinuate or with the margins gaping. Muscular scars rather small, and not very distinctly marked. Surface features and hinge of the shell unknown.

A single internal cast of this species only is known. It presents very strong affinities with *Arca quinquedecemradiata* Gabb in nearly every particular, except in being very much smaller than the majority of that species; and were it not for the locality assigned to it (Crosswicks, N. J.), which would bring it in the Lower Cretaceous strata instead of at the very summit of that formation, as is the case with *A. quinquedecemradiata*, I should be very strongly inclined to consider it as only an immature or perhaps a dwarfed specimen of that species; but if the geological horizon is correctly assumed it might, on the examination of the exterior, whenever found, prove to be a distinct species. Therefore I have preferred to leave it as such until further information is obtained.

Formation and locality.—The specimen is in the collection of the Acad. Nat. Sci., Philadelphia, and is labeled "Crosswicks, N. J.," on what authority I cannot say, as the original label belonging to it does not bear any locality mark other than the letters "N. J."

Genus NEMODON Conrad.

(Am. Jour. Conch., Vol. V, p. 97.)

Nemodon Eufaulensis.

Plate XII, Figs. 3–5.

Arca (*Macrodon*) ***Eufalensis*** Gabb. J. A. N. S. Phil. 2d ser., Vol. IV, p. 398, Pl. LXVIII, fig. 38; Synop. p. 96. Meek, Geol. Rept. N. Jersey, 1868, p. 725.
Trigonoarca ***Eufalensis*** (Gabb) Conrad. Am. J. Conch., Vol. III, p. 9.
Nemodon Eufalensis (Gabb) Conrad. Am. Jour. Conch., Vol. V, p. 97, Pl. IX, Fig. 16.

Shell small, seldom reaching a length of one inch in the extreme. Form trapezoidal, the cardinal and basal margins subparallel, and the length about twice and a half as great as the height. Anterior end obliquely and rapidly receding from the extremity of the hinge and most rapidly on the lower half; posterior end obliquely truncate, prolonged backward below to the umbonal angle. Valves moderately ventricose, with a decidedly angular umbonal ridge behind, and a shallow mesial depression extending from the beaks to the basal border, slightly affecting the basal line near the middle of its length. Beaks large and rather prominent, situated at about the anterior third of the length. Area moderate. Surface marked by numerous fine radiating striæ showing upon the cast, which are a little coarser near the posterior angle and on the cardinal slope, possibly somewhat alternating in size on the anterior end, but indistinctly showing this feature on the internal cast. Hinge-line marked by two distinct linear teeth on the anterior end parallel to the hinge. Those of the rest of the hinge have not been observed.

This species differs from *A.* (*Cibota*) *multiradiata* Gabb, in being much longer in proportion to its height, as well as in its generic features, which are not always easily recognized in the casts.

Formation and locality.—In the Lower Green Marls at Holmdel, N. J., Mr. Conrad's specimen, which appears to havē been the foundation of the genus *Nemodon*, was from Haddonfield, New Jersey.

Nemodon angulatum.

Plate XII, Figs. 6 and 7.

Leda angulata Gabb. Proc. Acad. Nat. Sci. Phil., 1860, p. 94, Pl. II, Fig. 12. (Not D'Orb.)
L. subangulata Gabb. Synopsis, p. 133.
Nuculana subangulata (Gabb). Meek, Check-list, p. 8.
N. angulata (Gabb). Meek, Geol. Surv. N. J., 1868, p. 725.
Nemodon angulatum Gabb. Proc. A. N. Sci. Phil., 1876. p. 316.
Compare *Trigonarca passa* Conrad. Am. Jour. Conch., Vol. V, p. 43, Pl. I, Fig. 17.

The only specimen of this species which I have seen from New Jersey is an internal cast, which I take to be that figured by Mr. Gabb, as above cited, a copy of which figure is given on our plate. It is about twice as long as high, with rather prominent beaks situated at considerable distance from the anterior end, and with a prominent and angular umbonal ridge. The disk of the valve is broadly sinuate, giving a rather emarginate or concave basal line. The posterior end is somewhat narrowed and obliquely truncate, the basal angle being prolonged. Anterior end rather more broadly rounded. The surface characters and hinge structure are yet unknown.

In its general appearance the cast somewhat resembles *N. Eufaulensis*, but the beaks would appear to be very much more prominent and more nearly centrally situated. I strongly suspect this to be the same species more recently described as *Trigonarca passa* by Mr. Conrad, from a still smaller specimen, from Crosswick's Creek, though I have been unable to find any representative of that species in the collection of the Academy of Natural Sciences at Philadelphia, or elsewhere; and I may be mistaken in my inference.

Formation and locality.—In the Lower Green Marls in Burlington County, New Jersey.

Nemodon brevifrons.

Plate XII, Figs. 1 and 2.

Nemodon brevifrons Conrad. Kerr's Geol. Surv. N. Car., Appendix, p. 4, Pl. 1, Fig. 15.

Shell of moderate size, transversely subovate or subrhomboidal in outline, moderately convex, considerably less than twice as long as high, with moderate-sized beaks for an *Arca*, which are rather within the anterior third of the length, are but little projecting above the line of the hinge, and are closely approximate. Umbonal ridge prominent, strong, and rather inflated, leaving a rather narrow and somewhat abrupt posterior slope. Hinge-line a little more than half the length of the shell, and the cardinal area narrow and slightly sinuous. Anterior end of the shell somewhat broadly rounded, nearly evenly so above and below; basal margin broadly curved and the posterior end narrow, almost cuneate below and rapidly sloping above to the extremity of the hinge-line. Surface of the shell marked by fine subobsolete, radiating striæ, which form lines of small punctures where they cross the nearly equally fine concentric markings; these are strongest on the anterior and middle parts of the valves and become almost obsolete on the posterior slope and on the umbonal ridge. Substance of the shell, very thin. The teeth are three short laterals on the posterior end parallel to the margin, and three slightly curved ones on the anterior end also nearly parallel to the margin. Area, longitudinally striate.

This shell differs from *Arca* (*Nemodon*) *Eufaulensis* Gabb in being more inequilateral, more pointed and prolonged behind, more ventricose, less sinuate in the middle, and in the character of the radiating lines of the surface.

Formation and locality.—In the micaceous clay below the Lower Marls at Haddonfield, New Jersey. There may be some question as to the locality of this shell, as the locality is not marked on the label It was found among Haddonfield specimens in the collection of the Academy of Natural Sciences of Philadelphia, and is supposed to have come from that place. Still it is somewhat questionable.

Genus NEMOARCA Conrad, 1870.

(Am. Jour. Conch., vol. v, p. 97 (name only).

Nemoarca cretacea.

Plate XII, Figs. 8–10.

***Nemoarca cretacea* Conrad. Am. Jour. Conch., Vol. V, p. 97, Pl. IX, Fig. 21, 1870.**

Shell small, seldom attaining more than half an inch in extreme length, trapezoidal in form, the transverse diameter being nearly once and a half the height. Valves very ventricose, with large, strongly inflated, prominent beaks, situated nearly opposite the middle of the length. Hinge-line straight and low; area narrow, the length a little less than the greatest length of the body of the shell. Hinge-plate narrow, marked by about twelve short, oblique teeth which diverge from the center on each side, and two or three transverse teeth nearly parallel to the hinge line at the posterior end. Muscular imprints too faint to be observed on well-preserved casts of the interior. No internal rib bordering the posterior scar. Surface marked by from four to six fine radiating ribs on the posterior slope, and twenty-four to twenty-six on the body of the shell and anterior end. Strongest on the posterior part of the body of the shell and gradually decreasing in size anteriorly. On some individuals one or more of the ribs on the posterior slope appear to be divided, while all are strongly elevated and rather sharp with narrow interspaces. On the matrix there are remains of distinct elevated concentric lines at regular distances crossing the radiating ribs.

The description thus far is taken from internal casts and their matrices, and accord well with the description given by Mr. Conrad of *N. cretacea.* But since writing the above I have obtained from the collection of the Academy of Natural Sciences of Philadelphia, the type specimens of that species, which preserve the shell entire. The general form and features are the same, but the surface of the ribs are slightly flattened and the interspaces deep and narrow, and the ribs, about thirty of which may be counted on the body and anterior end of the shell, are beautifully cancellated by the concentric lines. The hinge area is moderately high, and is vertically striated except a narrow border around its outer margin. The teeth are ten on the posterior side, and six or seven on the anterior side of the beak.

The casts, except for the strength of the ribs, present much the features in size and proportions of *Cibota multiradiata* Gabb, but the beaks were not so distant, and the basal line is not emarginate at the point occupied by the byssal opening of that species. These features will serve to distinguish them quite readily.

Formation and locality.—Mr. Conrad's specimen was from Haddonfield, and the cast figured on the plate is from an iron-stone nodule found near Keyport, New Jersey. Both are from the lower portion of the Cretaceous formation.

Genus BREVIARCA Conrad.

(Appendix Kerr's Geol. N. Car., p. 3, 1872.)

Breviarca Saffordi.

Plate XII, Figs. 11 and 12.

Arca Saffordi Gabb. J. A. N. S., 2d ser., Vol. IV, p. 397, Pl. LXVIII, Fig. 37. Synopsis, p. 97. Meek, Check-list, p. 9.
Trigonarca Saffordi (Gabb). Meek, Geol. Surv. N. J., 1868, p. 725.
Breviarca Saffordi (Gabb). Conrad, Proc. Acad. N. Sci. Phil., 1872, p. 55, Pl. II, Fig. 3.

Shell rather small, ovately trapezoidal in outline, with strongly ventricose valves and large, tumid, subcentral beaks, which stand prominently above the hinge line, are incurved and approximate. Hinge line about two-thirds as long as the entire length of the valves, with a moderately high, vertically striated area, the striated portion being bounded by a plain border over which the striations do not extend. Anterior end sharply rounded and the basal line round and full. Posterior extremity oblique, extended somewhat below and rounding into the basal line. Posterior umbonal ridge rounded but quite distinct. Surface covered entirely with fine, slightly raised thread-like striæ, which are somewhat alternating in size on the postero-cardinal slope. Hinge plate moderately wide and distinctly arched on the inner margin, the line of teeth more distinctly arcuate. Teeth numerous, narrow, and diverging outward from beneath the beak, and gradually increasing in length to near the outer ones. Muscular impressions proportionally large and distinct, the posterior one having a slightly raised line on its anterior margin, but only seen in the larger specimens.

The species closely resembles, in its general form, *Idonearca Shumardi* of the Upper Missouri and Black Hills Cretaceous, but differs in being radiately striated, and in the form of the teeth. Among the Cretaceous forms of New Jersey it resembles in form *Nemoarca cretacea* Con. most nearly, but differs entirely in the form of the surface markings. These close resemblances show how entirely unsatisfactory are these close generic divisions. The specimen which I have figured on Plate xii, figs. 11 and 12, appears to be the same with that used by Mr. Conrad for generic figures in 1872, and I have made the figures as accurately as it is possible to measure the specimen.

Formation and locality.—In the micaceous clays beneath the Lower Green Marls at Haddonfield, New Jersey. From the collection of the Academy of Natural Sciences of Philadelphia.

Genus TRIGONARCA Conrad. 1862.

(Proc. A. N. S., 1862, p. 289, and Am. Jour. Conch., Vol. III, p. 9.)

Trigonarca cuneiformis.

Plate XII, Figs. 17 and 18.

Trigonarca cuneiformis Conrad. Am. Jour. Conch., Vol. V, p. 98, Pl. IX, Fig. 1.

Shell quite small, not exceeding half an inch in extreme length in any of the examples yet observed. Trapezoidal in outline and quite ventricose. Hinge but little more than one-half the length of the shell, and the area very narrow. Beaks small, slightly incurved. Anterior end of the shell regularly rounded; posterior end elongate, produced below, the posterior margin very oblique, so as to make the postero-basal angle quite acute. Hinge-plate very narrow, marked by oblique transverse teeth, the anterior end having ten or twelve directed inward below, and the posterior a somewhat larger number pointed in the opposite direction. Muscular impression large, the posterior one bordered by a slightly elevated lamella on the anterior margin. Surface of the shell marked by radiating lines, strongest on the anterior end and faintest on the middle of the valve; also by concentric lines which cross them and form slight pustules at the junctions.

The specimens used are Mr. Conrad's types, a right and a left valve, and an internal cast of a right valve. They have much the look of young shells, and may prove to be such when the locality is further examined The ligamental area is very narrow, and on the small specimens scarcely perceptible with an ordinary lens. The hinge-plate is reduced to almost a line in the middle, and the teeth and sockets are reduced to a minimum size, while a little posterior to the central part there is a short space destitute of either teeth or sockets. The ridge. bordering the posterior muscular impression is very slight and not at all thickened, so that in the cast the gash marking its place is scarcely perceptible.

Formation and locality.—In the micaceous clays of the Lower Marl Beds at Haddonfield, New Jersey. From the collection of the Academy of Natural Sciences of Philadelphia.

Trigonarca transversa.

Plate XII, Figs. 13–16.

Cucullæa transversa Gabb. P. A. N. Sci., 1861, p. 326.
C. transversalis (Gabb). Meek, Check-list, p. 8.
Idonearca transversa (Gabb). Meek, Geol. Surv. N. J., 1868, p. 725.

Shell of medium size, transversely ovate, nearly twice as long as high, exclusive of the large, prominent, slightly incurved and distant beaks, which are situated at about the anterior third of the length of the valve. Valves very ventricose, with a long hinge-line reaching to near the anterior end and nearly two-thirds as long as the greatest length of the shell Anterior end not extending beyond the hinge-line, but curving with a broad sweep into the basal line below, which is almost regularly but broadly curved;

posterior extremity pointed and the posterior margin very obliquely truncate, straight on the margin or slightly concave, but on many of the casts appearing rounded from the wearing away of parts, or perhaps from the thickening of the shell on the inside. Surface of the casts showing indications of plications or ribs which when well-preserved appear to have been strongest near the posterior part of the body of the shell, and gradually decreasing in size until they become fine striæ on the anterior end. Their form, posterior to the umbonal ridge, cannot be determined from any of the examples examined. Muscular imprints large, but faintly marked; the ridge bordering the posterior one not strong and scarcely indicated, but sometimes represented by a broad, shallow furrow in the cast.

The specimens which I have identified as belonging to this species do not agree in all particulars with the description as given by Mr. Gabb; but it is the only one known in the New Jersey beds which will at all approach it that has not been figured by the authors of the species. The principal difference consists in the surface striæ, which he says are "numerous." This, one would naturally interpret as *fine*, but on the best preserved examples which I have examined they are broad toward the umbonal slope, measuring nearly a line in width. It is possible they may have been double, but there are no indications of it, and on shells of this class, where the substance has been very thick, the casts are often marked by a series of vascular lines, which appear as radiating striæ, but which have no immediate connection with the external striæ, and it may have been these which he refers to. The internal muscular plate he says is "low and broad." On the example borrowed from the collection of the Academy of Natural Sciences of Philadelphia, this is the case, and I suppose it to be the example used by Mr. Gabb, although found in the collection without name. From *A. quindecimradiata* he says it differs in having "probably twice the number of ribs and by being more convex." I have seen quite a number of examples of the form he figures under that specific name, but they do not retain the markings of the surface, but are marked with several strong, distant vascular ridges; but these are not representatives of the surface striæ, and so far I have no evidence of what its surface may have been. Besides, they are usually more convex; that is, the valves are deeper according to the size of the shell than any of the examples which I have seen of this species. I do not think, however, that there can be any doubt that the form here identified is that which the author had before him when the description was written. There is so much diversity also in the general form and expression of examples of this type, when represented only by internal casts, owing to the greater or less thickening of the valves with age and other peculiarities, that it is extremely difficult to draw the line of specific distinction between them; and it becomes a serious question if many of the species founded on these casts may not be the same with forms described under other names from other localities where the shell itself is preserved. This question, however, can only be settled by obtaining impressions of the exterior from the beds where the casts are found, by carefully made collections. Until this is done these specific determinations will have to be accepted.

The casts of this species have the general form and make-up of Conrad's genus *Trigonarca*, and if these divisions are to be accepted will necessarily fall into that place.

Formation and locality.—In the Lower Marls at Burlington, Mullica Hill, and, perhaps, Arneytown, New Jersey; the latter being the locality mentioned with doubt by Mr. Gabb.

Genus CIBOTA Browne.

Cibota rostellata.

Plate XI, Figs. 34–36.

Arca rostellata Morton. Synop., p. 64, Pl. III, Fig. 11.
A. rostellata (Mort.). Meek, Geol. Surv. N. J., 1868, p. 725.
Cibota rostellata (Mort.). Gabb, Synop., 109. Meek, Smiths. Check-list, p. 9. Stoliczka, Pal. Indica, p. 346.

Shell trapezoidal and very oblique, the length being about twice and a half the height, with subparallel cardinal and basal margins, posterior end very obliquely prolonged below, and the anterior end rather rapidly rounding backward from near the hinge-line to its junction with the base. Basal margin very perceptibly sinuate nearly opposite the beaks and apparently very slightly gaping. Valves moderately inflated, most ventricose on the umbones just anterior to the sulcus, which crosses them from the beak to the sinus of the base, and then rapidly declining to the anterior extremity, but sloping quite gradually on the posterior side. Beaks moderately large, somewhat projecting above the hinge and slightly incurved; situated at about the anterior third of the entire length of the valves. Cardinal area moderate in size and extending about two-thirds of the length. Teeth unknown. Surface as indicated on internal casts marked by radiating ribs, pretty fine and numerous on the anterior end and in the mesial sulcus, becoming much coarser posteriorly, and showing a slight tendency to alternation in size between the sulcus and posterior umbonal angle, and on the cardinal slope a tendency to bifurcation in some cases.

The species is not a very abundant one, but is sufficiently distinct to be readily detected when found. It differs from *C. uniopsis* Conrad, found in the same beds, in being more prolonged behind, in the smaller mesial sulcus coarser and more direct ribs and less quadrangular form.

Formation and locality.—The only examples which I have observed from the State are from Freehold, N. J., and are from the Lower Green Marls; Dr. Morton's types having been found in Alabama, being not often found at Prairie Bluff and vicinity. Mr. Gabb and Mr. Meek both cite it as from New Jersey, but do not credit it to any other locality.

Cibota uniopsis.

Plate XI, Figs. 32 and 33.

Arca uniopsis Conrad. J. A. N. S., Phil., n. ser., Vol. II, p. 275, Pl. XXIV, Fig. 17. Gabb Synop., p. 98. Meek, Check-list, p. 9.
A.? *uniopsis* (Con.). Meek, Geol. Surv. N. J., 1868, p. 725.

Shell rather above a medium size, transversely elongate, and trapezoidal or subrhomboidal in outline, with moderately convex valves, which are broadly sulcated in the middle, particularly on the right valve, and only moderately elevated beaks, situated at about the anterior third of the length, and which in the casts appear to have been scarcely enrolled and moderately distant from each other. Hinge-line not quite as long as the body of the shell, in the cast showing characters of a rather low area; anterior end obliquely rounded, receeding below; basal line broadly sinuate and the posterior end obliquely truncate, longest below the center. The surface appears to have been marked only by slender radii, as none are preserved on the casts. Muscular scars only faintly impressed.

Casts of this shell are usually found in collections marked *C. rostellata*, and somewhat closely resemble those of that species, but they are proportionally broader, with the beaks more nearly central; the valves are more ventricose behind, and fuller along the basal line, with a decided sulcation near the middle, on the right valve more marked than on the left, while on the exterior the markings have been decidedly finer. It is extremely difficult to distinguish among the casts of this group of shells, as the characters often change much according to the thickness of the substance, causing them to lose or retain the form or surface-markings to a greater or less degree. But the differences noted between this and its nearest allies will, I think, serve to distinguish these readily.

Formation and locality.—Conrad's type came from the Lower Green Marls near Burlington, New Jersey, and I should conclude from the lithological characters of the others which I have seen that they are all from that region, and probably all from the same bed.

Cibota obesa, n. sp.

Plate XI, Figs. 30 and 31.

Shell small, with full and very ventricose valves, large tumid beaks situated opposite the anterior third of the length, slightly enrolled, and distant from each other as shown on the internal cast. Form of the outline trapezoidal, the length of the cast nearly twice the height, exclusive of the projection of the beaks; anterior end vertically rounded; posterior obliquely truncate; extremity obtusely pointed; basal line full, but constricted just anterior to the middle by the very marked but short and broad byssal opening; area two-thirds the length of the valve and moderately wide. On the casts the muscular imprints are very distinctly marked and of fair size, no muscular ridge; the outer margin indicating a strong and abrupt thickening of the valves with a crenulated border; radiating lines indicating moderately fine striæ show on nearly all parts of the cast, but strongest on the postero-basal section.

The general form of this species is like a dwarfed and extremely ventricose specimen of *C. uniopsis* Conrad, but is so perfectly neat and symmetrical in its shape as to preclude the idea of a stunted individual. The valves are, however, equally ventricose, while those of that species usually are slightly unequal and sometimes very decidedly so. The form of the byssal opening is also peculiar, being broadly oval and regular instead of a long narrow slit, as is usual.

Formation and locality.—The only specimen which I have seen is an internal cast from the collection of the Academy of Natural Sciences of Philadelphia, and is marked "Cibota, n. sp., Burlington Co., N. J."

Cibota multiradiata.

Plate XI, Figs. 21 and 22.

Arca ? multiradiata Gabb. Proc. A. N. Sci., Phil., 1860, p. 95, Pl. II, Fig. 1. Synopsis, p. —. Meek, Check-list, p. —. Geol. Surv. N. J., Pl. LXVIII, p. 725.
Cibota multiradiata Gabb.
Comp. *C. cretacea* Conrad, Am. J. Conch., Vol. V, p. 97, Pl. IX, Fig. 21.

Shell small, the type specimen measuring only about five-eighths of an inch in length. Valves transverse, very ventricose, with a wide curved cardinal area, and moderately prominent, distant beaks situated at about one-third of the length from the anterior end. Posterior end obliquely truncate, longest below; anterior end narrowly rounded, very gradually receding from the extremity of the hinge; basal line gently convex throughout, the margins of the valves slightly gaping just anterior to the middle of their length. Hinge-line nearly as long as the shell below, and on the cast very slightly curved. Muscular scars small and faint, the posterior one bounded by a constriction on the cast which leaves a furrow extending from the margin of the valve to near the beak. On the margin of the cast there occurs minute crenulæ which indicate the existence of strong but closely arranged radiating plications on the surface of the shell.

The general form of this cast is like that of *Nemoarca cretacea* Conrad, but the specimen is somewhat larger than any of those which I have referred to that species, and the beaks are more distant, while that species is not emarginate on the base, being without the byssal opening so distinct in this one.

Formation and locality.—The only individual known is in the collection of the Academy of Natural Sciences, Philadelphia, and is labeled as coming from Mullica Hill, New Jersey, which would place it in the Lower Marl Beds.

Genus IDONEARCA Conrad.

(P. A. N. Sci. Phil., Vol. XIV, p. 289; *ib.*, p. 54, 1872.)

Idonearca Tippana.

Plate XII, Figs. 19-21.

Cucullæa Tippana, Conrad. Jour. A. N. Sci., Phil., 2d ser., Vol. III, p. 329, Pl. XXXV, Fig. 1. Gabb, Synop., p. 118. Meek, Check-list, p. 8.
Idonearca capax, Conrad. Proc. A. N. Sci., Phil., 1872, p. 54, Pl. II, Fig. 2.
Not *Idonearca capax*, Conrad. Jour. A. N. Sci., Phil., new series, Vol. III, p. 328, Pl. XXXV, Fig. 2.

Shell of medium size, inequilateral and obliquely triangular, with deep valves and a very angular umbonal ridge and abrupt posterior slope of but little width; beak only moderately prominent; incurved and approximate. Cardinal area only moderate, compared with those of the other species associated with it. Hinge-line about half as long as the shell or a little more. Anterior end broadly rounding into the basal margin which is nearly straight in its posterior part, and the postero-basal angle strongly marked. Surface, so far as can be judged from the cast, marked only by concentric lines. Muscular ridge, as indicated by the gash left in the cast, large and strong, reaching nearly to the margin of the valve, and situated nearly midway between the umbonal ridge and the cardinal border. Anterior muscular scar not distinctly traceable. Hinge teeth and features not plainly seen. Edge of the valves on the interior surface crenulate.

The New Jersey casts agree very closely indeed with the figure of *I. Tippana* given by Mr. Conrad, in form, size, and general character, although the strong language used in his description would somewhat mislead in the absence of specimens. With examples of the shell also from Alabama they correspond very closely. It is the most distinctly triangular form occurring in the New Jersey formations, which form, together with the sharply angular umbonal ridge and abrupt postero-cardinal slope, will serve to distinguish it from any other form exteriorly. Casts of the interior, however, made from one of the Alabama specimens, is so very similar to the smaller casts of *I. vulgaris*, that it would require a critical eye indeed to detect the differences. The hinge of the Alabama specimen above referred to is very broad and the shell very thick; the teeth are strong and few in number, and do not differ very materially from those of *I. vulgaris* so far as those have been observed. A figure of the Alabama specimen is added on the plate by the side of the New Jersey specimen for comparison with the other forms. Mr. Conrad would appear to refer the New Jersey shells to his *I. capax*, in the Proceedings of the Academy of Natural Sciences, Philadelphia, 1872, p. 54, as he figures one which he states is from New Jersey, on pl. ii, fig. 2 of that volume, but on comparison with the original figure of that species in the Jour. A. N. Sci., new series, vol. iii, pl. xxxv, fig. 2, one will readily see that this identification must be very erroneous, as that shell, which is from Mississippi, is of very different shape and has a very much shorter hinge-line than the New Jersey specimens, while a comparison with fig. 1 of the same plate will show to which the New Jersey examples belong.

Formation and locality.—In the indurated green earth beneath the Middle Marl ~~Bed~~, at the deep cut of the Holmdel and Keyport turnpike, Monmouth County, New Jersey.

Idonearca antrosa.

Plate XIII, Fig. 6-11.

Cucullæa antrosa, Morton. Synopsis, p. 65, Pl. XIII, Fig. 6. Gabb, Synop., p. 116. Meek, Check-list, p. 8.
Idonearca antrosa (Morton). Meek, Geol. Surv. N. J., 1868, p. 725.
I. antrosa (Morton). Gabb. Proc. A. N. Sci., Phil., 1876, p. 315.
I. neglecta Gabb. Proc. A. N. Sci., Phil., 1876, p. 314, = *Cucullæa neglecta* Gabb. *Ib.*, 1861, p. 326.

Shell subcircular in outline, or very slightly ovate from being a little prolonged at the postero-basal angle, very slightly oblique with a straight hinge line, which is about half as long as the greatest length of the shell. Beaks large, erect, and slightly incurved, but not projecting beyond the edge of the proportionally small ligamental area which is marked by oblique grooves, as in all species of the group. Surface of the shell slightly angulated along the postero-umbonal slope and very convex; marked by numerous strong concentric lines of growth at irregular distances; no radiating striæ. Hinge-plate narrow in small and medium sized specimens and the teeth small, but barely bend down at their inner extremity and few in number; the denticulations along the middle of the hinge vertical and small. On large individuals the outer teeth are strong, from four to five in number on each side, according to the size of the individual; slightly declining outwardly, and the bent portion usually nearly half as long as the horizontal portion, the bending being at an angle within ninety degrees, the denticles on the middle part of the hinge being small and numerous. Muscular scars, as seen on the casts, strongly marked; the impression of the ridge deep, strongly arched, and situated pretty well up on the posterior slope; surface of the cast marked by rather strong vascular lines. The outer margin of the cast is bordered by a strong keel, indicating the great thickening of the valves along the pallial line.

The internal casts of the species, the condition in which it is usually recognized, are quite globose, with distant and highly projecting beaks; the hinge-line being strongly curved in large specimens, and the strong projecting keel extends around three sides, being broadest on the anterior. In these casts there is seldom any evidence of the hinge structure preserved, and it is rarely that we find specimens which give any clue to these parts of the shell. A single large individual from Freehold, N. J., preserving the shell in part, I was enabled to manipulate so as to get the impression of the teeth on each end of the hinge, and to some extent the line of small teeth between them. These show very decidedly the features of *Idonearca* as established by Mr. Conrad.

Among the specimens which I have referred to this species, there are several from a white sandy layer from Holmdel, N. J., in the cabinet at Rutgers College, which are labeled *C. neglecta* Gabb. There are others of the same kind also from white sandy nodules occurring at the base of the Lower Marl Bed at Marlborough, N. J., in Mr. Schanck's collection, borrowed for this work. These specimens preserve the shell in most instances, and furnish the features of the shell as given above. Mr. Gabb described these as a distinct form under the name *C. neglecta*, but I can see no reason for considering them as distinct from *I. antrosa* Morton. Of course their appearance is very different when the shell is retained from that presented by the internal casts alone, and the hinge features are quite inconspicuous in these small shells as compared with that shown to exist in the large specimen figured. Still all the features are there, and it only needs the strengthening of these by increase of growth to make them the same.

Formation and locality.—Those preserving the shell, including those marked *Cucullæa neglecta* by Mr. Gabb, are from nodules of white sandy marl at the base of the Lower Green Marls at Marlborough, Monmouth County, and from the same horizon near Holmdel; the former from Mr. Schanck's collection and the latter from the Rev. M. Riley. Casts of the *I. antrosa* have been recognized at very many localities of the Lower Marl Beds, among which Holmdel, Freehold, and Monmouth are the most prominent. One specimen of a cast from Freehold is very large, and must have measured quite three and a half inches transverse diameter when entire. The largest specimen from the nodules of white sand, which retains the shell in part, would measure, if restored, fully two and three-fourths inches.

Idonearca vulgaris.

Plate XIII, Figs. 1–5.

Cucullæa vulgaris Morton. Synopsis, p. 64, Pl. III, Fig. 8, and Pl. XIII, Fig. 5. Gabb, Synop., p. 118. Meek, Check-list, p. 8.
Idonearca vulgaris (Conrad). Meek, Geol. Surv. N. J., 1868, p. 725. Gabb, P. A. N. Sci., Phil., 1876, p. 313.
Cucullæa terminalis Conrad. Mex. Boundary Surv., p. 148, Pl. IV, Fig. 2.

The casts of this species are often large and indicate a rather ponderous shell, which often attained a considerable size, was trapezoidal in form, very ventricose, and very oblique. The beaks, as shown on the casts, are large, elevated, and distant, with a strongly angular umbonal ridge extending from them backward to the postero-basal angle. The postero-cardinal slope is short and quite abrupt, and the junction of the valves strongly keeled when perfect, though this part is often broken away. The portion representing the line of the cardinal area is curved, and the gash on the postero-cardinal slope formed by the muscular ridge is deep, often wide in old individuals, is situated above the middle of the slope, and extends from the edge of the keel, at this point, to fully two-thirds the distance between the margin and the beaks. Anterior muscular scar often distinctly marked, but faint in many cases. Body of the cast radially striated.

A cast of a single right valve, which I have referred to this species, preserves the impression of the hinge to some extent, but not sufficiently perfect to show the character of the hinge-line along its middle portion. The valve is less ventricose than many of those where the two are in contact. The hinge-line is just two-thirds as long as the length of the shell, and the plate has been wide at the extremities, the teeth have been nearly parallel to the outer line, not bent or inclined downward as in *I. antrosa.* There are four indentations and four ridges on the posterior end, and apparently two on the anterior end; but their inner ends are not visible, consequently I cannot see if they were recurved at this point.

There is great variability in the general form, in the degree of obliquity, in the ventricosity of the valves, in the distance between the beaks, and in the abruptness of the posterior-cardinal slope, among the specimens which it seems necessary to refer to this species. Much of this is apparently dependent on the age of the shells and on the thickening of the valves, especially along the pallial line. I have not seen any specimens which give the slightest evidence of the surface features of the shell, so that of this feature I can say nothing. The species is distinguished from the associated forms principally by its extreme ventricosity and the obliquity of the valves as seen in the casts; and in most specimens the gash representing the muscular ridge is deeper than in the other forms. In the younger individuals the form is proportionally less ventricose, and consequently the beaks are nearer each other and the posterior slope less abrupt.

Formation and locality.—Casts of this species are found at very many of the localities of the Lower Green Marls throughout the extent of the formation in the State. There are specimens before me from Holmdel, Freehold, Woodbury, Burlington, Mullica Hill, and Marshallville, New Jersey. The species is also recognized from Prairie Bluff, Ala., and it is cited by Mr. Gabb and Mr. Meek from the State of Delaware.

Genus AXINEA Poli.

Axinea Mortoni.

Plate XI, Figs. 23-25.

Axinea Mortoni, Con. Am. Jour. Conch., Vol. V, p. 44, Pl. I, fig. 14.
A. hamula and *A. australis* (Mort.) Gabb. Synop., p. 103, Proc. A. N. S., 1876, Vol. II, p. 317, Meek, Check-list, p. 8.
A. rotunda and *A. subaustralis* Meek. Geol. Surv. N. J., 1868, p. 725.
A. subaustralis D'Orb. Prod. de Pal., p. 243, No. 667.

Among the shells of *Axinea* obtained from the cretaceous beds of New Jersey are two distinct species, one of which is nearly circular in outline, being only very slightly oblique, and with very ventricose valves. The other is more elevated, less rotund, and very equilateral. There appears to have been much uncertainty in the minds of most authors who have studied these shells as to their specific identity and also as to their relations with those from other localities. Dr Morton describes two species in his synopsis, from Prairie Bluff, Ala., and mentions a third species which he says occurs in the "marls of New Jersey." In Vol. V, p. 44, Am. Jour. Conch., Mr. Conrad gives this last the name *Axinea Mortoni*, giving a figure but no description. While Messrs. Gabb and Meek have considered the New Jersey specimens as the same with those from Prairie Bluff, Ala., D'Orbigny takes the name of one of Morton's Prairie Bluff species, *P. australis*, and substitutes a new name, *P. subaustralis*, for it, and cites New Jersey as the locality (Prod. de Pal., Vol. II, p. 243, No. 667). The Alabama specimens, of which I have seen casts, are all small, but are broader in proportion to their height than are those from New Jersey, while the beaks are sharper and have a decided anterior inclination. Considering all the above facts, I am inclined to consider the New Jersey forms as distinct from either of the Alabama species, and to adopt Mr. Conrad's name *Axinea Mortoni* for the smaller and more rotund of the two species, that one corresponding most nearly with the figure which he gave with the name. The shells are found of various sizes up to an inch and an eighth in height, with a transverse diameter somewhat greater, while the thickness of the united valves slightly exceeds three-fourths of an inch. The form is nearly circular, slightly oblique, the valves most ventricose on the umbonal region. Area very small, short, and narrow. Surface marked by concentric lines of growth, and rather even subobsolete radiating striæ. The internal casts, which I have identified as the same, show the hinge plate to have been fairly wide on the sides, and to have been marked by eight or nine teeth on each side, as far as can be seen outside of the breadth of the filling of the beak, which are directed very nearly or quite at right angles to the line of the inner border of the plate. Inner margin of the cast strongly crenulate.

The shell in its general form closely resembles *A. rotundata* Gabb, described from the Cretaceous beds at Eufaula, Ala., but is more ventricose, more distinctly striate, has a rather smaller area, and possesses a little obliquity, which that species does not show. Mr. Gabb, in the Proceedings of the Academy of Natural Sciences, Philadelphia, 1876, p. 317, considers all the New Jersey forms and the Georgian shells as of one and the same species, and refers with but little doubt *A. bellasculpta* Con. to the same, but says nothing about his previously-described *A. rotundata.* He also speaks of seeing and using the types of Dr. Morton's species, which I have not been able to find, and, strange to say, I have not found a single individual of *Axinea* from New Jersey in the Academy collections.

Formation and locality.—In the Lower Marls of the Cretaceous at Holmdel; Walnford, Manalapan, at George Hunt's pits, N. J.; Mr. Conrad cites Crosswicks, New Jersey.

Axinea alta, n. sp.

Plate XI, Figs. 26–29.

The casts of this species are usually somewhat larger than those of *A. Mortoni*, and are more elevated at the beak; the fillings of the rostral portions being very long and curved inward toward each other, showing that the hinge-plate has been very wide, and the beaks probably considerably projecting beyond its margin. In these casts the portion which extends above the line of junction of the plates of the two valves measures about two-fifths of the entire height of the cast. Muscular scars rather large and distinct, the line of advance being marked on both by a distinct ridge on the cast. Margin of the cast below the pallial line, broad, and the border strongly crenulate. Teeth strong and but few in number, and distinctly bent downward at their inner ends, while their direction is more lateral than in *A. Mortoni.* Central parts of the hinge, cardinal area, and exterior of the shell unknown.

Among the New Jersey specimens the elevated beaks, less rotundity of the valves, and stronger and more outwardly directed teeth will serve to distinguish this from *A. Mortoni.* From the Alabama and other southern species there is almost no means of comparison, as no part of the shell of this one has been seen.

Formation and locality.—In the Lower Marl Beds of the Cretaceous at C. Bruere's pits, Walnford; also at Upper Freehold, New Jersey.

NUCULIDÆ.

Genus NUCULA Lam.

Nucula percrassa.

Plate XI, Figs. 4-6.

Nucula percrassa Conrad. Jour. A. N. S., new ser., Vol. III, p. 327, Pl. XXXV, Fig. 4. Gabb, Synop., p. 149. Meek, Check-list, p. 8. Geol. Surv. N. J., 1868, p. 725.
N. percrassa Gabb. Proc. A. N. Sci., Phil., 1876, p. 318.

A single cast of this species occurs in the collections of the A. N. S., Phil., sent to me in a tray with two specimens of *Cibota uniopsis* Con., from New Jersey, and probably from near Burlington, but without distinctive mark, either as to species or locality. The lithological features of it are quite different from those of the *Cibota* in the tray, and I presume it to be from Haddonfield or in that vicinity. The species has been recognized by several authors as coming from New Jersey, and consequently I have figured this specimen as presumably from within the State.

The cast is more elongate than any of those of *N. Slackiana* Gabb, the nearest allied form, and the shell has been more thickened. The cast is about as long again as high, with very large projecting beaks, which are situated at about the anterior third of the length. The muscular scars are very strong, and the pallial line very well marked. The teeth, as indicated on the cast, have been quite numerous, and extend on the posterior side to the muscular scars, but are obliterated on the anterior side. The ligament pit is well marked, but not prominent. No markings of the exterior are preserved, the shell having been too thick to transmit them.

The shell has been proportionally more elongate than *N. Slackiana*, while nearly of the same height, and the beaks, I should judge, were farther removed from the anterior end. I think the species quite distinct from that one, and well worthy of being retained as valid.

Nucula Monmouthensis, n. sp.

Plate XI, Fig. 1.

Shell rather below a medium size, triangularly ovate, with convex valves and sharp, pointed beaks, which are even with the anterior end of the shell. Posterior hinge-line long and straight; anterior end truncate and at right angles to the postero-cardinal line; basal line ventricosely convex, more sharply rounded near the anterior truncation; posterior extremity of the valves narrowly rounded. Anterior slope vertical, or nearly so, forming an angulation which extends from the beak to the antero-basal margin; postero-cardinal slope abruptly rounded. Surface of the shell marked by fine concentric lines, and a few distant varices of growth; no radiating striæ can be distinguished on the surface. Posterior hinge with about twenty sharp, somewhat recurved teeth; anterior side not observed; ligamental pit moderate in size.

This species differs in shape from any American Cretaceous species yet described. It approaches most nearly *N. distorta* Gabb (Jour. A. N. Sci., Phil., new series, Vol. IV, p. 396, Pl. LXVIII, Fig. 34), from the Ripley group of Tennessee, but is much less distinctly triangular, and does not possess the radiating lines of the surface as in that shell.

Formation and locality.—In the white limestone nodules of the lower Cretaceous marls at Marlborough, N. J. A second specimen, rather more curved on the postero-cardinal margin, occurs in the collection of the Academy of Natural Sciences of Philadelphia, from Haddonfield, New Jersey, in soft micaceous sand.

Nucula Slackiana.

Plate XI, Figs. 2 and 3.

Leda Slackiana Gabb. A. N. S., Phil., 2d ser., Vol. IV, p. 397, Pl. LXVIII, Fig. 37. Synopsis, p. 133.
Nuculana Slackiana (Gabb). Meek, Check-list, p. 8. Geol. Surv. New Jersey, 1868, p. 725.
Nucula Slackiana Gabb. Proc. A. N. S., Phil., 1876, p. 318, but doubtfully referred to *N. percrassa* Gabb.
? *N. percrassa* Gabb. Proc. A. N. S., 1876, p. 318.
Not *N. percrassa* Conrad. J. A. N. S., 2d ser., Vol. III, p. 327, Pl. XXXV, Fig. 4.

Shell of rather large size for the genus. General form ovate, elongate-triangular, or subelliptical; about once and a half as long as high, with the anterior end obliquely truncate, but rather long; cardinal line slightly arcuate; base gently curving and the posterior end rather sharply rounded, and almost obtusely pointed near the line of the hinge. Muscular scar as seen on the internal cast large and distinct on the anterior end, less strongly so on the posterior. Teeth strong on the posterior side and gradually decreasing toward the beak; twenty may be counted on the cast figured. Those of the anterior side not seen. Margin strongly and deeply crenulate. Surface of the shell marked with fine radiating striæ, which are but faintly marked on the body of the valve, but are much more strongly developed near the margin, meeting the crenulations of the edge of the shell so as to deeply indent the border. Also by strong concentric lines of growth. Internal structure of the shell strongly fibrous.

Mr. Gabb remarks, on page 318, Proc. A. N. S., Phil., 1876, that he has "little doubt this will prove to be identical with *N. percrassus*," a species, previously described, from Patula Creek, Georgia; a form much larger and of a slightly different shape. I think it extremely doubtful if this opinion be correct, however, for according to the figure of that species, it is much more triangular in form than this one. On account of which difference, in the absence of authentic specimens of that species with which to compare, I should prefer to consider them as distinct. There can be no doubt about the generic relations of this shell, as the form is entirely unlike that of *Leda* and *Nuculana*.

Formation and locality.—In the micaceous clays, under the Lower Marl Bed, at the Rev. G. C. Schanck's pits, near Marlborough, New Jersey. Mr. Gabb's specimens were from Crosswicks, New Jersey.

Nucula perequalis.

Nucula perequalis Conrad. J. A. N. Sci., Phil., new ser., Vol. IV, p. 281. Meek, Geol. Rept. N. J., 1868, p. 725.

Mr. Conrad describes this species as follows: "Triangular, rather elongated, equilateral, ventricose; dorsal margins equally declining; end margins acutely and equally rounded; basal margins regularly rounded." The locality given is Eufaula, Barbour County, Alabama.

Mr. Meek cites this as a New Jersey species in his list given in the Geological Report for 1868, p. 725. I have not been able to find Mr. Conrad's type specimen, and as he did not figure it, it is nearly impossible to identify a form of this character from so imperfect a description. Moreover, as the species was originally described from a Southern locality, I feel some doubt in regard to its correct identification from New Jersey without personal inspection. Some of the shorter specimens of *N. Slackiana* Gabb agree nearly with the above description, but I have preferred to adopt the name which is accompanied with a figure rather than one without, where there is so much uncertainty as in this case.

Genus NUCULANA Link.

Nuculana protexta.

Plate XI, Fig. 10.

Leda protexta Gabb. J. A. N. Sci., Phil., new ser., Vol. IV, p. 303, Pl. XLVIII, Fig. 23 on Plate XXIII in text.
Nuculana protexta Gabb. Proc. A. N. Sci., 1876, p. 318. Meek, Geol. Rept. N. J., 1868, p. 725.
Not *Leda protexta* Gabb. J. A. N. Sci., Phil., Vol. IV, Pl. LXVIII, Fig. 36, p. 397.
Not *Yoldia protexta* Conrad = *Y. albaria*. Con., Am. Jour. Conch., Vol. I, p. 213, Pl. XXI, Fig. 2, Vol. III, p. 8.

Shell very elongate and narrow, the narrow end about once and a half as long as the wider and strongly recurved. Valves moderately ventricose and the beaks only moderately elevated; anterior end narrowly rounded and the posterior extremity extended and narrow; basal line gibbous in the middle. On the cast the hinge is seen to be marked by a very large number of small teeth, but the number cannot be made out on any of the several specimens examined. The cartilage pit beneath the beak has been of moderate size. Surface features of the shell unknown.

This species very closely resembles *Perrisonota protexta* Conrad, sp., and would probably also fall under that genus if retained. It differs in being a little less elongated posteriorly, while the anterior or larger end is proportionally very much more elongated, throwing the beaks more nearly in the middle of the length of the shell. The posterior cardinal slope is not flattened and distinctly separated from the body of the shell by an indistinct ridge as in that species. There has been considerable confusion in regard to the use of the specific name *protexta* in this group of shells, as it has been applied to three distinct species at different times. Two of them given by Mr. Gabb and one by Mr. Conrad. I have retained it for this species as it is the earliest application of the name. Mr. Conrad changed his species to *Yoldia albaria* (=*Nuculana albaria* as herein used), and I have changed Mr. Gabb's second one to *Nuculana Gabbana;* so that at present only one species bears the name.

Formation and locality.—In the Lower Green Marls at Crosswicks, and at Mullica Hill, New Jersey. There are several specimens of the casts in the collection of the Academy of Natural Sciences at Philadelphia from each of the above mentioned localities, and one of those which I have figured I suppose to be that originally figured by Mr. Gabb as above cited, but it is labelled as from Crosswicks, N. J., while under the description Mr. Gabb cites only Gloucester County, New Jersey.

Nuculana Gabbana, n. sp.

Plate XI, Figs. 11–13.

Leda protexta Gabb. J. A. N. Sci., Phil., new ser., Vol. IV, p. 397, Pl. LXVIII, Fig. 36.
Not *Leda* (*Nuculana*) *protexta* Gabb. *Ibid.*, p. 303, Pl. XLVIII, Fig. 23 (24 in text), or Meek, Geol. Surv. N. J., 1868, p. 725.
Not *Nuculana protexta* Conrad. Am. J. Conch., Vol. I, p. 147, Pl. II, Fig. 6 (Eocene) = *N. albaria* Con.

Shell of moderate size, extremely elongated, the length being nearly twice and a half the extreme height. Valves convex, regularly and evenly rounded. Beaks small, appressed and incurved, and distinctly inclined toward the narrower end of the shell, scarcely rising above the hinge-line on the wider part, and situated about two-fifths of the length from the larger end. Cardinal margin on the wider end gently arcuate and a little more strongly concave on the narrower side of the beak; large extremity of the shell sharply rounded; basal margin gently rounded throughout and the posterior end narrow and rounded. As the specimen is an internal cast, it preserves no evidences of the surface characters. The muscular scars are extremely faint and the pallial line undistinguishable, although the cast is in an excellent state of preservation and somewhat polished on the surface from the perfect condition. The hinge-line has been marked by a large number of very fine teeth, gradually increasing in size from the center outward. On the wider end of the shell there are about twenty-five visible under a glass and about twenty somewhat stronger ones on the narrower side of the beak. The ligamental pit has been of moderate size, but well marked and deep. A single cast of this species was found in the collection of Princeton College, labeled *L. protexta* Gabb in a handwriting which I supposed to be Mr. Conrad's. The cast differs materially from that of *L. protexta* Gabb, as given on Plate XLVIII, Fig. 23 (24), Jour. A. N. Sci., Vol. IV, in the proportional length of the shell and the narrow posterior extremity, but corresponds very well with that figured afterwards on Plate LXVIII, Fig. 36, from Tennessee; consequently I have deemed it proper to separate it under a distinct name.

Formation and locality.—In the Lower Green Marls at Freehold, New Jersey.

Nuculana longifrons.

Plate XI, Figs. 16 and 17.

Leda longifrons Conrad. J. A. N. S., Phil., 2d ser., Vol. IV, p. 281, Pl. XLVI, Fig. 18.
Gabb, Synop., p. 133.
Nuculana longifrons (Con.). Meek, Check-list, p. 8.

Shell of moderate size, transversely subelliptical or subovate in form, a little narrower behind than in front of the beaks. Beaks very small and inconspicuous, situated rather more than one-third of the entire length from the anterior end of the valve. Cardinal margin very gently declining on each side of the beaks; anterior end rounded, longest above the middle of the height; posterior end more narrowly rounded, longest just below the extremity of the hinge; basal line very gently curved in the middle and more abruptly so toward the extremities. Surface of the shell polished, but marked by extremely fine concentric striæ of growth. In the interior the hinge-line is marked by proportionally long curved teeth; those on the anterior side being largest and numbering fifteen or twenty, those of the posterior side very small and numerous.

The largest individual of the species which I have seen measures about one inch and a quarter in length. It is very imperfect, however, and too poor for illustration. The species may be recognized by the great height of the shell across the posterior extremity, and by the almost regularly elliptical form of the valve and absence of the recurving of the posterior side, as in most species of the genus. None of the five individuals before me show the ligamental pit beneath the beak on the hinge-area, in consequence of which I am not able to fully determine if it is a true *Nuculana*, or if it may more properly belong to the genus *Yoldia*.

Formation and locality.—In fine micaceous clay at the base of Cretaceous at Haddonfield, New Jersey. Mr. Conrad's type specimens were from a similar deposit at Eufaula, Barbour County, Alabama.

Nuculana pinnaformis.

Plate XI, Figs. 7 and 8.

Leda pinnaforma Gabb. J. A. N. S., Phil., 2d ser., Vol. IV, p. 303, Pl. XLVIII, Fig. 22 (by error, 23 in text).
L. pinnæformis Gabb. Synopsis, p. 133.
Nuculana pinnæformis (Gabb). Meek, Check-list, p. 8, and *N. pinnaformis* (Gabb), Meek, Geol. Surv. N. J., 1868, p. 725.

Shell minute, the only example seen being only one-fourth of an inch in length. Form elliptically cuneate, very ventricose, and comparatively broad across the beaks, with the posterior extremity pointed. Beaks large and rather prominent, directed backwards, and situated about two-fifths of the length from the anterior end. Anterior end broadly rounded, a little pointed at the longest part; basal line extremely gibbous. Postero-cardinal margin depressed, forming a narrow, almost linear, depressed area along the margin from the beaks to the posterior extremity. Surface of the shell marked by comparatively strong concentric lirations, which die out at the edge of the depressed area bordering the cardinal line. Interior and hinge features not observed.

This species is nearly of the size of *N. compressifrons* Conrad, but is broader in comparison to its length, more pointed at the extremity, has the beaks situated farther from the anterior end, and has the surface strongly lirated, while that one is smooth. The single individual used in the description was observed among the specimens of *N. compressifrons* from the collection of the Academy of Natural Sciences of Philadelphia, but without any distinctive mark, and is evidently from the same locality. It is somewhat longer proportionally than the figure given by Mr. Gabb *loc. cite.*, but is doubtless the same species.

Formation and locality.—From the micaceous clay of the Lower Marls at Haddonfield, N. J. Mr. Gabb cites his specimen from Burlington County, New Jersey, an extremely large locality for so small an object.

Nuculana compressifrons.

Plate XI, Fig. 9.

Yoldia compressifrons Conrad.
Leda protexta Gabb. J. A. N. S., Phil., N. S., Vol. IV, p. 397, Pl. XLVIII, Fig. 36. Not *L. protexta* Gabb, *Ibid.*, p. 303, Pl. XLVIII, Fig. 23.

Shell of medium size, barely exceeding half an inch in length in the largest individuals observed. Outline elliptically cuneate and moderately ventricose. Posterior end nearly twice as long as the anterior, and narrow but not exactly pointed, the extremity being slightly rounded. Anterior end broad. Beaks prominent and comparatively large; basal line gibbous opposite the beaks and imperceptibly sinuous just forward of the posterior extremity of the shell. Escutcheon narrow, forming a depressed line along the postero-cardinal border. Surface of the shell smooth and usually polished, although occasionally showing regular concentric lines. Hinge showing eight to ten teeth on the anterior end and about fifteen on the posterior side. Teeth short. Ligamental pit very small, if observable at all.

It is extremely difficult to draw comparisons between this and other forms of the genus. Among New Jersey species it may be distinguished by its broad form and smooth surface. The larger individuals of the species were in the collection of the Academy of Natural Sciences labeled *Nuculana protexta* Gabb, Ripley group, Haddonfield, N. J., apparently in Mr. Gabb's own handwriting. They certainly are not identical with the cast of that species originally used by Mr. Gabb and figured in the Journal of the Academy of Natural Sciences, Vol. IV, Pl XLVIII, Fig. 23. The smaller specimens were separated in a tray by themselves and labeled *Yoldia compressifrons* Conrad, Haddonfield, N. J., but they only differ in size, and it is possible they may only be the young of the same shell with the Princeton specimen figured as *N. protexta* Gabb.

Formation and locality.—In micaceous clay of the Lower Marl Beds at Haddonfield, New Jersey (collection of Academy of Natural Sciences of Philadelphia.

Genus PERRISONOTA Conrad.

(Am. Jour. Conch., Vol. V, p. 98.)

Perrisonota protexta.

Plate XI, Figs. 14 and 15.

Perrisonota protexta Conrad. Am. Jour. Conch., Vol. V, p. 98.

Shell small, ensiform, extremely elongated posteriorly, and gradually narrowed from the beaks. Valves depressed convex with very small inconspicuous beaks, which curved backward, and with an obsolete carination extending from them backward to the postero-basal angle. Anterior end broadest, sharply rounded; posterior end narrowly rounded, longest above the middle. Hinge-line arched upward in front of the beaks, and gently concave posteriorly throughout the entire length of the shell. Basal line moderately curved, more prominent just in advance of the beaks. Surface of the shell polished or marked by very fine concentric lines of growth, except on the posterior cardinal slope, where they unite and form a few inconspicuous folds. The interior of the shell shows the hinge-line to be marked by several small transverse teeth on the anterior side, and on the posterior side they extend almost to the hinge extremity.

This species is the type of the genus *Perrisonota*, but the characters are so nearly those of *Nuculana* that there seems to be nothing but the general form of the shell for it to rest upon. Dr. Stoliczka remarks this lack of distinction in his Pal. Indica, but seems in doubt as to the teeth on the anterior side of the hinge-plate. These are certainly present in the type specimens, although Mr. Conrad does not mention them, and they bear the same proportion to those on the posterior side that they do in *Nuculana*. The only character in which it can be said to differ from *Nuculana* is in the greater proportional width of the cardinal slope, the more distinct umbonal angulation, and in having the posterior hinge-teeth continued nearly to the extremity of the shell, characters which do not seem to be of generic importance.

Formation and locality.—In fine micaceous clays of dark color at Haddonfield, New Jersey, near the base of the Cretaceous. The specimens used are from the collection of the Academy of Natural Sciences of Philadelphia.

Genus NUCULARIA Conrad.

(Am. Jour. Conch., Vol. V, pp. 44 and 98 (name mentioned only).)

Nucularia papyria.

Plate XI, Figs. 18-20.

Nucularia papyria Conrad. Am. Jour. Conch., Vol. V, p. 44, Pl. I, Fig. 7, p. 98, Pl. IX, Fig. 25.

The shells of this species are quite small and very ventricose, especially in the anterior half, and becoming rapidly depressed posteriorly. The largest individual present in the collection barely exceeds three-eighths of an inch in length. The form is irregularly subovate, a very little wider across the shell opposite the beaks than elsewhere. Beaks very small and obscure, located at about the anterior third of the length and incurved. Hinge-line nearly straight behind the beaks, but rather rapidly declining in front and rounding into the curvature of the anterior end. Basal margin subparallel to the posterior part of the hinge-line, and the posterior end rounded above and obliquely truncate or rounding forward below, so as to materially shorten the basal line. Surface of the shell polished, but marked by exceedingly fine concentric lines of growth. Hinge-plate very obscure, and its characters mostly unknown or extremely doubtful. A fragment of a shell in the collection, labeled by Mr. Conrad as of this species, shows five small teeth, which appear to represent the anterior section of the hinge-plate, and a cast of a right valve shows that the posterior part has had a single long lamelliform tooth parallel to the margin of the shell. No evidence of transverse teeth on this part appears. Muscular impressions and pallial line entirely invisible. Substance of the shell dense, but not nacreous.

There are eight individual valves or casts of valves of this species before me, besides the fragment showing hinge-teeth, but none of them are in a condition to remove the doubt concerning the hinge structure. It appears to me quite doubtful if the specimen showing teeth really belongs to the same species. The fragment is not nearly so much curved as would be a fragment of equal size from any one of the specimens here present, and moreover, the piece is attached to a second fragment by a bit of paper pasted on the inside, so that I cannot actually examine the entire surface. This species is the type of the genus *Nucularia*, of which I have been unable to find a generic description. It is placed by its author under the family *Nuculanidæ*, but so far as the shells themselves afford evidence of their structure, I feel quite doubtful if it belongs here at all. If so, it must be quite near *Mellitia*.

Formation and locality.—In the micaceous clays of the Lower Marl Beds at Haddonfield, New Jersey.

TRIGONIDÆ.

Genus TRIGONIA Brug.

Trigonia Mortoni, n. sp.

Plate XIV, Figs. 5 and 6.

Trigonia thoracica Mort. Pars., Synopsis, p. 65. Gabb, Synopsis, p. 177. Meek, Check-list, p. 9. Geol. Surv. N. J., 1868, p. 725.

Species known principally as casts of the interior, which are subtriangular in outline, prolonged posteriorly and narrowed; the body standing nearly at right angles to the beaks and umbonal portions. Anterior end inflated, compressed, and almost attenuate posteriorly; filling of the beaks erect, scarcely incurved, and quite distant. Anterior muscular fillings large, prominent, and giving evidence of extremely deep impressions in the shell. Posterior scars moderately prominent, circular, or nearly so, submarginal and accompanied by a small secondary or pedal scar on the upper side nearer the hinge. Surface of the cast usually marked near the margin with strong, rather distant undulations, indicating strong curved costæ, of which there can be counted on some specimens ten or twelve, usually indicated only on the basal half of the valve, but rarely seen crossing the rostral portions of the cast and strongly arching upwards as they approach the margin. The postero-cardinal area has been comparatively narrow, and the casts usually show a single strong undulation on the upper side of the umbonal ridge, near the posterior extremity.

A single fragment of green marl retaining the impression of a part of the exterior of a shell has been obtained, which shows that the original form of the shell as it occurred in New Jersey was considerably different from those found in the more southern localities (Prairie Bluff, Alabama, and Texas), and usually referred to the same species with the casts from New Jersey. This specimen shows that the shell was considerably extended posteriorly, and also that there was a proportionately wide postero-cardinal area over which the radiating ribs did not extend, and which was separated from the body of the shell by a slight furrow, forming an area or corslet, as in most species of the genus. The radiating ribs on the posterior third of the shell are very oblique and very much smaller than the others, with shallow interspaces. Area marked by concentric lines only, which are much stronger here than on the body of the shell; crests of the ribs obscurely tuberculated on the anterior and median parts of the shell.

The species differs from *T. thoracica* Morton, as figured in his Synopsis, Pl. XV, Fig. 13, from a specimen retaining the shell found at Prairie Bluff, Ala., in the existence of the area or corslet bordering the posterior hinge-line as well as in the extended posterior extremity, and, notwithstanding the great similarity of the internal casts, has been very distinct externally when entire. In consequence of this difference it becomes necessary to separate the New Jersey species under a new name. As the name *thoracica* was applied to and illustrated by specimens from Alabama, it will have to be retained for that shell.

Formation and localities.—It has been observed in the Lower Green Marls at Freehold, Burlington, Monmouth, Holmdel, and other localities in New Jersey as internal casts. The external impression from which Fig. 6, Pl. XIV, is taken is from near Holmdel, and was collected by the Rev. Dr. Riley.

Trigonia Eufaulensis.

Plate XIV, Figs. 1-4.

Trigonia Eufalensis Gabb. J. A. N. Sci., Phil., Vol. IV, N. S., p. 396, Pl. LXVIII, Fig. 32. Synopsis, p. 177. Meek, Check-list, p. 9. Geol. Surv. N. J., 1868, p. 725.

Mr. Gabb's description of this species is as follows: "Subtriangular, resembling *T. alæformis* Sow., in outline, not quite so elongated anteriorly; beaks posterior; lunule distinct; surface marked by about fourteen ribs, the more anterior of which proceed from the lunule anteriorly and then cross the shell at right angles with the lunule, exhibiting a tendency to being nodose, especially near the lunule; lunule marked by ten or twelve transverse ribs; cardinal margin somewhat incurved, anterior end subtriangular, basal sinuous and deeply serrate, posterior regularly rounded; internally, hinge teeth small; muscular impressions deep; pallial line entire; a small tooth-like ridge or process extends along the middle of the alation, as in *T. alæformis.*"

The above description is in some particulars rather incomprehensible, from the reversal of the anterior and posterior of the shell, as usually given by other authors. If these are considered it is much more lucid; and in the same way that which is termed the lunule would be the area bordering the cardinal line. The species very closely resembles what young individuals of *T. thoracica* must have been, but appears to possess more ribs proportionately for the size of the specimens. At the typical locality (Eufaula, Ala.) the specimens are always quite small, and considerably prolonged behind, with the basal margin strongly denticulated by the projection of the ribs The small cast figured has a larger number of ribs proportionally than have those from near Red Bank, one of which is also figured, and is more distinctly removed specifically from *T. thoracica* Morton.

Formation and locality.—In the micaceous clays of the Lower Marl Beds, at the "crossing of the West Jersey Railroad at a creek between Red Bank and Gloucester, N. J.," and in the green marls in Monmouth County. The former are from the collection of the Academy of Natural Sciences of Philadelphia, and the latter from the collection at Rutgers College.

Trigonia cerulia, n. sp.

Plate XIV, Fig. 7.

Shell small or below a medium size, moderately convex on the valves and of a triangularly-ovate outline. Beak small, appressed, obtusely pointed and erect; posterior hinge-line long and slightly concave; posterior end narrow and rounded; anterior end broadly rounded; basal line a little gibbous in the middle, but otherwise forming a continuous line with the anterior and posterior margins. Surface of the shell covered by coarse elevated ribs, which are flattened on their surfaces over a large part of the shell, but near the posterior cardinal margin are sharp and very slightly crenulated. The ribs are coarse and distant on the anterior and middle parts of the shell, but gradually become finer and more closely arranged toward the posterior part. Interspaces concave. No postero-cardinal area is visible on the specimen used, the ribs apparently passing, without interruption, across the entire disk of the shell and terminating on the cardinal margin. The ribs of the anterior end curve strongly forward in passing to the basal and anterior margins, while those of the hinder parts of the valve pass more directly across to the postero-basal margin.

This species differs from any of the others described from these beds in its form, but more particularly in the style and number of the surface ribs. They are more numerous than on any of the other forms, there having been about twenty-three on the specimen figured, which is only one inch and an eighth in length. Their flattened surface and the gradual increase backward is also the opposite from that which is seen to occur on those. In form it would correspond to the group *Pectinata*, and in the style of the ribs resembles *T. pectinata* Lam., except that the increase in number and size of ribs is directly opposite from what it is in that species.

Formation and locality.—In coarse olive green indurated marl at the deep cut on the Holmdel and Keyport turnpike, Monmouth County, New Jersey, at the base of the Lower Marls. The substance of the shell is entirely changed to *Vivianite*, which is soft and of a bright blue color, very easily destroyed by handling or rubbing.

Order SIPHONIDA.

Suborder INTEGRIPALLIATA.

CRASSATELLIDÆ.

Genus CRASSATELLA Lam.

In the Proceedings of the Academy of Natural Sciences of Philadelphia, 1872, p. 50, Mr. Conrad refers back to the American Journal of Conchology, Vol. V, p. 47, where he describes a new genus *Pachythærus* for the reception of all the Cretaceous, Eocene, and Oligocene *Crassatellas* which he considers as generically, or at least subgenerically, distinct from the Miocene and later forms of the genus, founding this opinion of an apparent difference in the size of the pit behind the cardinal tooth of the right valve, and the existence of a small pit behind the posterior cardinal tooth of the left valve of these older forms, which does not exist in the more recent ones; and also on the fact that the inner margins of these older ones are always crenulate, while *most* of the Miocene and recent forms are smooth. I do not, however, think these differences are of generic importance, and have not, therefore, adopted the division either in a generic or subgeneric sense. In the Appendix, pp. 5 and 6 of Kerr's Geological Report of North Carolina, Mr. Conrad describes the genus ETEA, also a division of *Crassatella*, and in the Proceedings of the Academy of Natural Sciences, 1876, p. 275, refers to it the following species: *Crassatella Monmouthensis*, *C. transversa*, *C. Delawarensis* Gabb, and *C. prora* Conrad. I have not thought it worth while to retain this division any more than the above.

Crassatella vadosa.

Plate XVII, Figs. 12–15.

Crassatella vadosa Morton? Synopsis, p. 66, Pl. XIII, Fig. 12. Gabb, Syn. Cret. Form., p. 113. P. A. N. Sci., 1876, p. 310. Meek, Check-list Smith. Inst., p. 11. Geol. Rept. N. J., 1863, p. 726. Stoliczka, Pal. Indica, p. 295.
C. lintea and *P. Repleyana* (Con.) Gabb. P. A. N. S., Phil., 1876, p. 310.
Comp. *Crassatella lintea* Con. J. A. N. Sci., new ser., Vol. IV, p. 279, Pl. XLVI, Fig. 5.
Comp. *Crassatella Carolinensis* Conrad. Kerr's N. Car. Rept., p. 6, Appendix.

This shell as usually identified in New Jersey is seen under two conditions of preservation, one as single valves preserved on the soft marl, the other as internal casts of both valves. The former is transversely broad-ovate, or very obscurely subtriangular, the valves rather moderately convex with a somewhat obscure umbonal ridge extending from the beak to the postero-basal angle. The shell is very high opposite the beaks, and rapidly narrows toward the posterior extremity to less than half the height at the former place. The anterior end is nearly one-third or more than one-third of the length of the entire shell, and is rounded, with the longest point below the middle of the height. Above this point the margin slopes rather rapidly and with but little curvature to the beaks. Beaks prominent and pointed. Posterior margin obliquely truncated, and the basal margin fullest and most sharply curved nearly opposite the beaks. The surface of all the specimens which I have observed from within the limits of the State have been more or less decayed. In fact, they are usually but little more than casts; but all preserve a very decided and well marked feature of the exterior shell, presenting strong, distant, and rather evenly distributed concentric ridges, which vary on different individuals from a sixteenth to a twelfth of an inch in width. The hinge-plate, as indicated on specimens where a single valve only is preserved, seems to have been tolerably wide, but the hinge features are never sufficiently preserved to give their characters. The muscular imprints are large and but faintly marked.

The second condition under which we see this form is as internal casts. In these the form is much the same as in the other, with, perhaps, a greater degree of variation, the beaks being sometimes nearly subcentral. The shell seems to have been very thick, the muscular scars very deep, and the pallial line remarkably thickened, the beaks prominent, with an extended rostral cavity beneath the surface, never showing any signs of the strong concentric undulations.

It is difficult to reconcile these two forms, which often occur together at the same locality and present such different aspects, with one's ideas of specific variation; but there have doubtless some conditions existed in the circumstances of their preservation which has caused the shell to be entirely destroyed in the one case while it has been partially preserved in the other, and which have at the same time prevented the surface markings from affecting the internal cast. Mr. Conrad's species, *C. lintea*, described from a small specimen from Alabama, appears to be the same species as the New Jersey shell, and neither of them would appear to differ materially from the Prairie Bluff specimens usually found in collections, and undoubtedly representing the same as that used by Dr. Morton. Mr. Gabb considers Conrad's *C. Repleyana* as a synonym of this species also, (see P. A. N. Sci., Phil., 1876, p. 310), and expresses a doubt if *C. Carolinensis* is not also the same.

Formation and locality.—The form referred to, *C. vadosa*, occurs in the Lower Green Marls at Holmdel, Freehold, and Burlington, New Jersey. The *C. Mortoni* has been noticed in the same beds at Holmdel and Freehold, but may occur at many other places.

Crassatella cuneata.

Plate XVII, Figs. 18–20.

Crassatella pteropsis Gabb. Jour. Acad. Nat. Sci., Phil., Vol. IV, 2d ser., p. 395, Pl. XLVIII, Fig. 28.
C. pteropsis (Gabb). Conrad, Am. Jour. Conch., Vol. V, p. 47.
Not *C. pteropsis* Conrad. *Ibid.*, p. 279, Pl. XLVI, Fig. 9.
Crassatella cuneata Gabb. Synopsis, pp. 112 and 113. See also A. Jour. Conch., Vol. V, p. 47.

Shell quite small, less than three fourths of an inch in length, subtriangular or subovate in outline and ventricose. Beaks prominent, elevated, and situated anterior to the middle of the length. Greatest width of the valves opposite the beaks. Anterior end broadly rounded and longest just below the middle of the height; posterior end much more sharply pointed and slightly prolonged; basal-margin gibbous opposite the beaks and slightly sinuate between the middle and the posterior end of the shell. Muscular imprints on the cast very strong and of large size. The above characters are taken from a cast. The figure given by Mr. Gabb, cited above, is of the shell itself, and is more distinctly triangular, with a very narrow posterior cardinal slope, and as a matter of course with more pointed and projecting beaks.

I have no doubt but that the cast from New Jersey is specifically identical with Mr. Gabb's specimen, and I find no other form which agrees with it among those described from within the limits of the State. The cast described above was found with the type specimen of *C. Monmouthensis* without separate label, but is clearly a distinct species. It is less oblique and more erect; the beaks more prominent and situated more centrally; the basal line is more gibbous in the middle and more sinuate just anterior to the posterior end, while this end is pointed and destitute of the oblique truncation characteristic of that species, given to it by the broad cardinal slope. The ventricose form and strongly marked muscular scars show it to be an adult specimen, notwithstanding its small size. It differs from *C. pteropsis* Conrad, described and figured in the same volume, from Tippah County, Mississippi, by its shorter triangular form, and very much less extended posterior part, which is also not recurved as in that one. In the American Journal, Conch., Vol. V, p. 47, Mr. Conrad expresses a belief that this is the young of his *C. pteropsis*, but I do not think it can be. He also remarks that he has seen it at Haddonfield of a smaller size than the Mississippi specimens and "a great deal shorter proportionally," which seems like straining a point to cover another species. The figure given by Mr. Conrad (Pl. I, Fig. 1) in the article above mentioned is also of a very different form from that originally figured as the type of the species.

Formation and locality.—In the Lower Green Marls of the Cretaceous at Monmouth, New Jersey. Mr. Gabb's specimen was from Hardeman County, Tennessee, and is also cited by him from Eufaula, Alabama. Mr. Conrad's specimen described under the same name was from Tippah County, Mississippi.

Crassatella Delawarensis, Gabb.

For references and description see page 210.

Mr. Gabb cites his type specimen as coming from the deep cut on the Delaware and Chesapeake Canal, which would be the Lower Marl Bed, but none of those which I have seen are from that horizon.

Crassatella Monmouthensis.

Plate XVII, Figs. 21 and 22.

Crassatella Monmouthensis, Gabb. Jour. Acad. Nat. Sci., Phil., Vol. IV, p. 302, Pl. XLVIII, Fig. 19. Meek, Geol. Rept. N. J., 1868, p. 727.
Etea Monmouthensis (Gabb) Conrad. P. A. N. Sci., Phil., 1876, p. 275.

Shell of small size and moderately oblique; in the condition of a cast, one-fourth longer than high, with moderately elevated beaks, which are strong, broad, slightly incurved, and situated at about one-third of the length from the anterior end. The hinge-plate has been strongly arched and of considerable width, especially on the anterior side of the beaks, with strong and proportionally large teeth and a rather moderate ligamental pit. Anterior end of the shell widest, round, and full; basal margin strongly arched and imperceptibly sinuate between the middle and the posterior umbonal angle. Posterior margin obliquely truncate and but little more than half as high as across the beaks. Umbonal angle sharp and very distinctly marked. Muscular scars strongly marked and of considerable size.

The specimen from which the above description is taken is an internal cast of both valves, which appears to be the original specimen figured by Mr. Gabb, as above cited. I found it in the collection of Princeton College labeled in Mr. Gabb's handwriting but without locality, but as Mr. Gabb gives Monmouth and Freehold as the two localities from which he had obtained it, it may safely be considered as from the Lower Marls.

There appears to be but very little difference between this species, as represented in the individual used in obtaining the above characters, and which I suppose to be the specimen used in the original description and for the figure given by Mr. Gabb, and that figured on the same plate (Fig. 20) as *C. Delawarensis*. This specimen is only an internal cast, while the other specimen retains the shell, but it is proportionally longer and differs in having a second ridge above the umbonal ridge.

Formation and locality.—In the Lower Green Marls of the Cretaceous at Monmouth, New Jersey.

Crassatella prora.

Plate XVII, Figs. 10 and 11.

Crassatella prora Conrad. Am. Jour. Conch., Vol. V, p. 43, Pl. I, Fig. 8.
Etea prora Conrad. P. A. N. Sci., Phil., 1876, p. 275.

Shell below a medium size, transversely subelliptical when considered exclusive of the projection of the beaks, but transversely broad triangular if they are considered. Valves rather ventricose for the genus; beaks very large, nearly central or a little nearest the anterior end, strongly projecting, and in the cast, the only condition in which it is known, nearly erect and moderately distant. Posterior cardinal margin regularly sloping from the beaks to the narrowly rounded posterior extremity; anterior side of the beaks excavated and the anterior end more broadly rounded than the opposite end; basal line broadly curved. Umbonal ridge scarcely angular. Surface, as shown on the casts, marked by comparatively strong, regular, concentric ridges, and marked just anterior to the umbonal angle by a proportionally broad sulcation passing from near the beaks to the base. Muscular scars distinct.

The species differs from any described form from the American Cretaceous in the ventricose valves, coupled with the large, nearly central, erect beaks and the evenly balanced transverse form.

Formation and locality.—In the Lower Marls at Crosswicks, New Jersey. The specimen figured is the type used by Mr. Conrad, and is from the collection of the Academy of Natural Sciences of Philadelphia, where it is accompanied by a much smaller individual of much the same form.

Crassatella subplana.

Plate XVIII, Figs. 14-16.

Crassatella subplana Conrad. J. A. N. Sci., Vol. II, new ser., p. 247, Pl. XXIV, Fig. 9. Gabb, Synop., p. 113. Meek, Check-list, p. 11.

Shell of about a medium size, somewhat subtriangular in outline; nearly as high as long, with compressed valves, subangular along the umbonal ridge, and with small, appressed, pointed, and erect beaks, which are situated a little in advance of the middle of the length. Anterior end of the shell rounded, the greatest length at or just below the middle of the height; posterior end subtruncate below and obliquely sloping to the beak above; basal line fullest anterior to the middle and just perceptibly sinuate between that point and the posterior umbonal extremity. Surface of the shell marked by more or less irregular elevated concentric ridges, which are flattened on the tops and separated by equally wide, concave, or flattened interspaces. Substance of the shell thick. The interior of the valves is marked with comparatively deep but not large muscular scars, a wide hinge-plate, and strong, well-marked teeth; margin crenulate. The internal casts are distinguished by their proportional height and compressed valves.

This species is the most elevated form of *Crassatella* found in the New Jersey Cretaceous, and may be distinguished by this feature from any of the others. In the younger stages of growth the shells are much more nearly quadrangular in outline and sometimes more ventricose than the specimens figured. In this condition they very closely resemble *C. curta* Conrad from the Miocene of Virginia.

Formation and locality.—In the Lower Marl Beds at Bruere's pits, on Crosswicks Creek, near Walnford, and near Cream Ridge, New Jersey. Mr. Conrad's types which are here figured were obtained from Arneytown, New Jersey, and borrowed from the Academy of Natural Sciences of Philadelphia.

Crassatella transversa.

Plate XVII, Figs. 16 and 17.

Crassatella transversa Gabb. P. A. N. Sci., Phil., 1861, p. 364. Synopsis, p. —. Meek, Check-list, p. —. Geol. Surv. N. J., 1868, p. 726.
Ætea transversa (Gabb) Conrad. P. A. N. Sci., Phil., 1876, p. 275.

Known from a single internal cast, representing a shell of moderate size, with proportionally ventricose valves, which have a transversely elongated form and rather prominent erect beaks, situated at about the anterior third of the length, and are rather distant from each other in the cast. The anterior end is rather broadly rounded, and the posterior part prolonged and narrow, with the extremity pointed below and curved downward, leaving the basal line somewhat broadly sinuate in the posterior third, and very strongly convex opposite the beaks. The muscular scars have been large and deep, being very strongly marked and prominent on the casts, and the pallial line strong, with the border of the valve outside of the line very much thickened and the margin strongly crenulate.

The cast representing this species, that used by the author in the original description, is very much more transverse than any other described from New Jersey, except *C. Delawarensis* of the same author. It is a larger species, however, than that one, and of an entirely different form, being destitute of the angularity of the umbonal region, and more narrowed and curved posteriorly with a rounded anterior end. In form it presents many features in common with *C. protexta* Conrad, from the Eocene sands at Claiborne, Ala., but has been a much more ventricose and thicker shell, with larger and more distant beaks, and more strongly marked muscular scars. It would appear to have been a very rare species, as I have observed only the one cast among all the collections which I have examined.

Formation and locality.—The specimen is in the collection of the Academy of Natural Sciences of Philadelphia, and on the labels accompanying it is simply marked "Cret, N. J.," without more definite locality.

Genus SCAMBULA Conrad, 1869.

(Am. Jour. Conch., Vol. V, p. 48.)

Scambula perplana.

Plate XVIII, Figs. 8–10.

Scambula perplana Conrad. Am. Jour. Conch., Vol. V, p. 48, Pl. IX, Figs. 7 and 8.
Proc. A. N. Sci., Phil., 1872, p. 51, Pl. I, Fig. 2.
Crassatella perplana (Con. sp.) Stoliczka. Pal. Indica, Vol. III, p. 294 and 295.

Shell small, triangularly ovate, very transverse, with very sharp, pointed, and recurved beaks, situated just within the middle third of the length of the shell and nearest to the anterior end. Valves flat, marked by fine concentric lines of growth and a few (three or four) broad, oblique undulations of the surface which pass from the posterior hinge-line backward to the basal margin. There are also a few obliquely concentric wrinkles on the antero-cardinal margin which extend only a short distance over the disk of the valve. Along the position of the posterior umbonal ridge, the surface striæ are abruptly deflected upward, marking the position of the ridge and defining the posterior slope of the valve. Posterior end of the valve narrow and truncate; anterior end obtusely angular; basal margin regularly and broadly arcuate. Inner margin of the valves crenulate; muscular scars small and faintly marked.

This shell presents all the appearances of a species of *Pandora*, or perhaps *Tellidora*, except in the hinge, where there are some slight differences. The left valve appears to have two cardinal teeth which are slightly curved, and are strongly crenulate on their inner or contiguous faces, also a long anterior and posterior tooth parallel to the margins. The opposite valve has a single cardinal tooth or ridge (cartilage bearing?), which would fit between those of the other valve, and a double ridge on the anterior side, forming a socket for the ridge of the left valve, and a single sharp ridge on the margin of the valve behind, which would fit between the ridge of the left valve and the carinated margin of the shell. This would allow the right valve to be smallest and to fit into the left. This arrangement of teeth differs from that of any species of *Tellidora* or *Pandora* which I have been enabled to examine, and would give pretty good grounds for separation from either of those genera The pallial line, so far as I can determine, has been simple. Dr. Stoliczka, in the Pal. Indica, Vol. III, pp. 294 and 295, in speaking of this shell, refers it to *Crassatella*, in which I think he is in error, and likens it to *C. radiata*, a species which I have not been able to examine While Mr. Gabb (Proc. A. N. Sci., Phil., 1876, p. 311), considers it generically identical with his genus *Anthonya*, described in the Pal. Calif., 1864, p. 181, and states that the hinges are identical in the two, but that the California shell is twisted, while this species is not, but thinks this of minor importance.

Formation and locality.—In the micaceous clays below the Lower Marls at Haddonfield, New Jersey, from the collection of the Academy of Natural Sciences of Philadelphia.

ASTARTIDÆ.

Genus GOULDIA Ad.

Gouldia decemnaria.

Plate XVIII, Fig. 4.

Gouldia decemnaria Conrad. Am. Jour. Conch., Vol. V, p. 48, Pl. IX, Fig. 4.

Shell minute, subquadrangular in outline and but slightly convex. Anterior and cardinal margins nearly at right angles with each other, the posterior and cardinal margins being rounded. Surface marked by very prominent, thickened, concentric ribs, parallel to the border of the valve, and separated by smooth, flattened interspaces. Hinge-structure and other internal characters unknown.

This small shell is scarcely more than a sixteenth of an inch in diameter, and the species is represented, so far as I know, by only a single left valve, imbedded in the clay in which it was found. The entire aspect of the specimen is that of a young *Crassatella*, and I am much inclined to think it is one, though I cannot demonstrate this opinion without risking the loss of the only example, and that a borrowed one. The specimen is marked on the card in Mr. Conrad's handwriting, *Gouldia septenaria*, but as I can find no such name in use, and as the specimen corresponds somewhat with the figure and description of *G. decemnaria*, I presume it to be a mistake in writing the label. The figure given by Mr. Conrad is much too pointed and more triangular than the shell would warrant, but in making figures so small as that which he gives, these differences can hardly be avoided.

Formation and locality.—In the micaceous clays of the Lower Marls at Haddonfield, New Jersey. Borrowed from the collection of the Academy of Natural Sciences of Philadelphia.

Gouldia Conradi, n. sp.

Plate XVIII, Figs. 1-3.

Shell small, the largest specimen observed not exceeding three-sixteenths of an inch in its greatest diameter. Valves subtriangular, approaching a quadrangular outline by the truncation of the posterior extremity, which gives the valves when seen from the exterior much the form and character of a young *Crassatella*, which is also added to by their moderate convexity. Beaks small and pointed. Anterior and posterior sides of the cardinal margin straight, forming a little more than a right angle with each other, the posterior side being nearly one-half longer than the anterior, and the basal line somewhat regularly rounded. Surface of the shell marked by concentric undulations, which are abruptly bent in crossing the umbonal ridge. Posterior umbonal slope flattened. Lunule rather long and narrow. Substance of the shell thin. Ligamental pit of the hinge small in the left valve, and the posterior cardinal tooth-cavity linear and extending nearly the entire length of the cardinal border. In the right valve the pit is larger and the anterior lateral tooth-cavity more strongly marked. Muscular scars and pallial line distinctly marked in the right valve (figured), but much less strongly so in the left one, which is thinner in substance, although a slightly larger valve.

I find no description or figure answering to this shell, and suppose it to have been hitherto undescribed, although it has existed among some miscellaneous material from Haddonfield, N. J., in the collection of the mention anything of the interior. The figure given by Mr. Gabb is so poor that, being of a specimen occurring outside of the State limits, I have not deemed it worth while copying, and think it highly improbable that it will be satisfactorily recognized as a New Jersey species.

Vetericardia crenulirata.

Plate XVIII, Figs. 5–7.

Astarte crenulirata Lea. Proc. A. N. Sci., 1861, p. 150. Conrad, J. A. N. Sci., new series, Vol. IV, p. 282, Pl. XLVI, Fig. 25. Gabb, Synops., p. 100. Meek, Check-list, p. 11.
Gouldia? crenulirata (Con.) Meek. Geol. Surv. N. J., 1868, p. 726.
Astarte corbicula Conrad. Am. J. Conch., Vol. III, p. 12.
Vetocardia crenulirata Con. Am. Jour. Conch., Vol. V, p. 43, Pl. I, Fig. 23, p. 48.
Vetericardia crenulirata Conrad. Proc. A. N. S., Phil., 1872, p. 52, Pl. I, Fig. 4.

Shell small, not exceeding one-fourth of an inch in length in adult individuals, subtriangular or broadly subelliptical in outline, with very ventricose valves and proportionally large, subêrect beaks, which are situated a little in advance of the middle. Surface marked by from thirteen to eighteen concentric varices, according to the size of the shell, which gradually increase in strength with increased growth of the shell. These become obsolete at the margin of the proportionally large and deeply impressed lunule. Interspaces flattened at the bottom, and about as wide as the sharply elevated varices. There are also fine, but distinct elevated radiating lines crossing the ridges and interspaces, becoming much stronger on the spaces than on the ridges. In the interior the muscular imprints are faintly marked and of moderate size, and the margin of the valves is strongly and deeply crenulated by the radiating ridges. Hinge-plate moderately strong and the teeth well marked.

This is a very pretty and well-marked species. The hinge structure would seem to warrant its removal from the genus *Astarte*, but it does not correspond with *Gouldia* any better, as was thought by Mr. Meek, and Mr. Conrad subsequently proposed the genus *Vetocardia* for its reception, which he afterwards changed to *Vetericardia*. Mr. Lea seems to have first described it, as is indicated by Mr. Conrad's reference in the American Journal of

Conchology, Vol. III, p. 12, although he did not figure it. As Mr. Conrad was doubtless familiar with Mr. Lea's types, which I have not seen to know them as such, he was undoubtedly correct in the identification.

Formation and locality.—In the micaceous clays below the Lower Green Marls at Haddonfield, New Jersey. Borrowed from the collection of the Academy of Natural Sciences of Philadelphia.

LUCINIDÆ.

Genus LUCINA Burg.

Lucina cretacea.

Plate XVIII, Figs. 23-25.

Cyclas cretacea Conrad. Name found on label in collection. Species figured by Conrad, without name or description, in Am. Jour. Conch., Vol. V, Pl. IX, Fig. 14, and hinge on opposite side of plate.

Shell rather below a medium size, subcircular in outline, with the anterior and posterior cardinal margins forming a very broad angle (140° to 160°) with each other; giving in some instances a nearly straight hinge-line, with the rather small, pointed beaks slightly projecting beyond the line, and a slight excavation in front, formed by the depression of the very narrow lunule; while behind the beaks the ligament is deeply sunken between the projecting shell margins. Surface of the shell marked by strong lamellose concentric lines, which are rather distant, and where there has been no wearing or abrasion they sometimes roll backward, and form a hollow rounded concentric ridge. On the posterior side the shell is marked by a rather deep constriction passing from the beak to the posterior margin just behind the umbonal ridge, or sometimes giving a sunken postero-cardinal area. In the interior the muscular markings are very deep and strong, and the hinge-plate narrow, the right valve being characterized by a single cardinal tooth, which is grooved on the surface, and by an anterior pit.

The shell was found in the collection of the Academy of Natural Sciences of Philadelphia with a label marked "Cyclas (Klein) Cretacea, Conrad," apparently in Mr. Conrad's own handwriting, with the locality, "Haddonfield," and on the plate cited above are two figures of the shell;

but I can find no description of the species or reference to the figures, and I presume none were ever written. I have, however, retained Mr. Conrad's specific name, although it cannot belong to the genus *Cyclas* of Klein if we are to accept *Lucina divaricata* as the type of the group as given by many authors. With regard to the true generic relations of the shell I am not certain, but it seems to possess the characters of *Lucina dentifera* Jonas, as given in Chenu's Manual, so far as they can be ascertained from the very imperfect material, not having the lateral teeth developed to any perceptible extent.

Formation and locality.—In the micaceous clays below the Lower Marls at Haddonfield, New Jersey.

Lucina Smockana, n. sp.

Plate XVIII, Figs. 21 and 22.

Shell of about a medium size, nearly circular in outline, as shown on internal casts, with comparatively ventricose valves and evidences of a somewhat thickened shell. Fillings of the rostral cavities distant, directed gently forward and almost centrally situated in reference to the outline of the shell; also with appearances of a deep, rather wide, lunular area and a moderate inflection of the valves along the ligamental groove. Muscular scars of moderate size, the anterior ones reniform, as long again as wide; the posterior one longer and proportionally narrower; pallial line entire, well marked, and situated near the margin of the valves, and from its indentation on the cast would indicate a considerable thickening of the shell just outside of its limit. Along the posterior umbonal slope there is a broad, distinct furrow on the cast, showing the existence of a decided furrow below the postero-cardinal margin. Hinge characters and surface structure of the shell unknown.

A single well-preserved cast, of one and five-eighths inches diameter, occurs in the collection of the Academy of Natural Sciences of Philadelphia, giving the features above described. The specimen has been studied by some one, and marked on its surface in ink "Dosinia, N. J.," showing its source to be from this State. The want of sinus in the pallial line forbids its reference to the genus *Dosinia.* I can find no described species answering to its characters, and have therefore considered it as new.

Formation and locality.—The character of the cast would indicate that it had been derived from the Lower Marls, and probably from Freehold, although there is no evidence further than its character by which to locate it.

CHAMIDÆ.

Genus DICERAS Lam.

Diceras dactyloides, n. sp.

Plate XVIII, Figs. 26 and 27.

A cast of a single valve of what appears to be without question a *Diceras* occurs in the collection. It is rather slender in its proportions, and makes nearly two-thirds of a volution in its curvature, and is apparently a cast of a left valve, judging from the curvature of the beak. The muscular scar is very large, and has been deeply impressed in the shell, as the scar is considerably raised on the cast and is nearly half as long as the cast itself. On its front margin there is the filling of a deep groove, which is longitudinally marked with lamellose striæ, from the edges of the shell lamellæ; and on the opposite side of the cast occurs a flattened surface from the thickening of the shell below the hinge-tooth, probably.

The striations on the filling of the groove bordering the muscular imprint would lead one to suspect the cast might be of a valve of *Caprina*, but their lamellose character somewhat denies this reference, and the general character of the specimen would rather indicate a *Diceras.* The specimen is quite obscure, besides being the only one known, and consequently affords almost no means of comparison with previously described species. It, however, appears much more slender in its proportions than the species known from Texas and other southern localities, as well as more strongly enrolled.

Formation and locality.—In the Lower Green Marls, at Bruere's pits near Walnford, on Crosswicks Creek, Monmouth County, New Jersey.

CARDIIDÆ.

Genus CARDIUM Linn.

Cardium Eufaulensis.

Plate XX, Figs. 17–19.

Cardium Eufaulensis Conrad. J. A. N. S., Phil., 2d series, Vol. IV, p. 282, Pl. LXVI, Fig. 12. Gabb, Synop. Cret. Form., p. 106. Meek, Check-list Smith. Inst., p. 12.
C. (*Trachycardium*) *Eufaulensis* Meek. Geol. Rept. New Jersey, 1868, p. 726. Gabb, P. A. Nat. Sci., Phil., 1876, p. 310.
Acanthocardium Eufaulensis (Conrad) Stoliczka. Pal. Indica, p. 215.

Shell of rather more than medium size when fully grown, very ventricose in profile and obliquely broad-ovate in outline, with a decided straightening of the posterior margin. Beaks large, prominent, and incurved. Surface marked by about forty strong, rounded, closely-arranged, radiating ribs, which have a rather decided posterior curvature in their direction toward the margin, and increase pretty uniformly in size and strength from the anterior to the posterior of the shell.

On an internal cast which I have referred to this species the cardinal teeth have been strong and very prominent; the antero-laterals have been moderately developed, but the postero-laterals do not seem to have been strongly marked.

The specimens examined from New Jersey are either casts or partially exfoliated, so that the surface features are not definitely known. The species has been variously referred to different sections of the genus, but the specimens which I have seen will not afford the means of determining its position.

Formation and locality.—In coarse dark-colored marls of the Lower Bed near Holmdel, New Jersey. Collected by Rev. Dr. Riley.

Cardium Ripleyanum.

Plate XX, Fig. 14.

Cardium Ripleyanum Conrad. Am. Jour. Conch., Vol. V, p. 96, Pl. IX, Fig. 6.
Not *Cardium Ripleyense* Conrad. Jour. A. N. Sci., Vol. III, new series, p. 326.

Mr. Conrad's description of this species is as follows: "Suborbicular, equilateral, ventricose; ribs 21, broad anteriorly, narrow posteriorly; interstices crossed by prominent lines. *Locality*—Haddonfield, N. J." I have seen only a few casts and one or two impressions of this shell in iron-stone nodules from Keyport, N. J. The shell is minute, scarcely measuring more than an eighth of an inch in diameter, erect with rather prominent pointed beaks. Outline somewhat circular, or a little higher than wide, ventricose, and with from eighteen to twenty or twenty-two prominent ribs, which are most prominent on the anterior parts of the shell. I have not been able to see fully the hinge characters, but there is evidence of a single strong tooth beneath the beaks. The general aspect of the shell, however, is more that of *Cardita* than of *Cardium.**

Formation and locality.—In the iron-stone nodules found in clays at Keyport and vicinity, associated with *Inoceramus*, *Scapharca*, *Pteria*, *Cymella*, and other Cretaceous shells.

Cardium Ripleyense Conrad.

(Jour. A. N. Sci., Phil., Vol. III, p. 326.)

This species is not cited from any locality, nor is it figured in any place so far as I can ascertain. The species according to the original description would fall under the division *Criocardium* Conrad, if accepted, so would not be quite a synonym of *Cardium Ripleyanum* Conrad, herein described. Mr. Conrad's description of the present species is as follows: "A small cordate species, with minute equal radii, between each of which is a series of comparatively long hair-like spines." I have seen no specimens which will answer to these characters.

Genus CRIOCARDIUM Conrad, 1870.

Cardium (Criocardium) dumosum.

Plate XX, Figs. 9-13.

Cardium dumosum Conrad. Am. Jour. Conch., Vol. VI, p. 75.
Criocardium dumosum Conrad. Am. Jour. Conch., Vol. VI, p. 75.

Shell of medium size, ventricose, with moderately large erect beaks, strongly enrolled. Shell but little oblique and very broadly ovate in outline, the posterior side very slightly straightened, and the hinge-margin only slightly arcuate. Umbones slightly gibbous, with the posterior umbonal slope just perceptibly more abrupt than the anterior side and of about equal width. Surface of the cast marked near the border of the valves by moderately strong crenulations, of which about six may be counted in the space of a fourth of an inch on the basal margin of the specimen figured. The cast as compared with that referred to *C. multiradiatum* Gabb is less ventricose, with less abrupt postero-cardinal slopes, smaller and less elevated beaks, and a proportionally broader and less arcuate hinge-border; and the indications of striæ on the surface somewhat coarser. The surface of the shell which I have supposed to belong to this species, both from the form of the shell as indicated by the cast and in the matrix from which the surface is obtained, and from indications of the ribs on the posterior side of the cast figured, has been covered by radiating ribs, which are smooth and flattened on the surface, and are characterized by rows of short spines or granules in the depressions between; every third depression bearing spines, and the two intermediate ones having granules only on the body of the shell, with sometimes a single row only between the rows of spines on the sides of the valves. The spines are only moderately long, and appear to have been slightly recurved and laterally compressed, while the granules are rounder and arranged more closely, there being from three to six in the distance between the spines. This character of surface is very distinctive as compared with that referred to *C. multiradiatum*, where every rib has its spines, though mostly arranged on the sides instead of exactly in the depression, as in this case. I cannot find that any figure has been given of the species by the author, but from the nature of his reference to the form of *C. multiradiatum* in his description, cannot doubt the correctness of the reference here made.*

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* Since writing the above I have seen a single imperfect valve of this species from Haddonfield, N. J., preserving some of the shell. The characters are exactly as those given above, while the concentric lines crossing the ribs are much stronger, forming minute lamellæ, but not spines in any sense of the word.

Formation and locality.—The specimens on which I have founded this species are marked as from near Burlington, New Jersey, and are in the

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*Subsequently I obtained from the collection of the Academy of Natural Sciences at Philadelphia specimens preserving the shell, marked "Haddonfield, N. J.," on which the character of the surface as described above is clearly shown. One of these is labeled *Cardium dumosum* Conrad, subgenus *Cardea*, and the other *C.* (*Trach.*) *Alabamiensis*, Gabb. The former in Mr. Conrad's handwriting, and the latter in Mr. Gabb's, so far as I can determine. They are, however, both the same species, and both individuals are figured on one plate.

collection at Rutgers College, New Brunswick, while Mr. Conrad's specimens were from Haddonfield, New Jersey, near Philadelphia. All of these localities are in the Lower Green Marls.

Cardium (Criocardium) multiradiatum.

Plate XXI, Figs. 1-3.

Cardium multiradiatum Gabb. Jour. A. N. Sci. Phil., 2d series, Vol. IV, p. 395.
Criocardium multiradiatum (Gabb) Conrad. Am. Jour. Conch., Vol. VI, p. 75, Pl. LXVIII, Fig. 29. Meek, Check-list, and Catal. in Geol. Rept. N. J., 1863.

Shell globularly ovate, extremely ventricose and cordate, with large, prominent, nearly erect beaks, which are strongly incurved but moderately distant in the casts, valves gibbously convex and perceptibly more prominent, but not angular along the posterior umbonal region; the posterior slope being perceptibly more abrupt than the opposite side of the valves. Basal margin of the shell rounded, the posterior side perceptibly more straightened and the anterior round; the whole valve being very slightly oblique. Muscular imprints large but not strong; cardinal tooth, as indicated by the imprint left on the valve, large and strong; lateral tooth unknown; inner margin of the shell crenulate, and slightly marked for a very short distance by the ribs. The exterior surface, which I have supposed to belong to this shell, as indicated in a matrix, has been marked by fine, closely set, and carinate ribs, the interstices between which are characterized by closely arranged and laterally compressed recurved spines, which are distant but little more than their own width from each other, and are often placed on the side of the rib.

Among the specimens which have usually been referred to this species from the Lower Green Marls are three very distinct species; but I have retained for this one that which is most finely and closely marked, on account of the signification of the specific name. Two of the forms are short-ovate and the third one elongate-ovate. This species, here considered, is the most ventricose of the two former, and it is also somewhat less in its antero-posterior dimensions as compared with the height from the beaks to the basal margin. It will be somewhat difficult to distinguish specifically between them in the casts, but the surface is so very distinct that it will not answer to include them longer under the same specific name. The other species, having alternately one or two small ribs with closely set spines or elevated granules between, and coarser ribs, with distant, strong spines, cannot easily be mistaken when the surface, or matrix, is examined. The figure given by Mr Gabb, cited above, is so poor that it cannot be satisfactorily determined which of these it was taken from. Both species are apparently members of the group *Trachycardium* of Mörch, 1852; while the present one would fall under the genus *Criocardium*, proposed by T. A. Conrad in 1870, and the other one into *Granocardium*, proposed by W. M. Gabb in the Palæont. of California, Vol. II. Mr. F. Stoliczka, in the Palæont. Indica, rather condemns both of these genera as being uncalled-for, with which idea I fully concur. The features make perfectly good specific distinctions among the ribbed forms of the *Cardiidæ*, but to make generic distinctions of every slight surface variation to which such shells are liable ought not to be tolerated.

Formation and locality.—The species has been recognized in the Lower Green Marls at Holmdel, Monmouth, Freehold, and Burlington, New Jersey; and Mr. Gabb's typical form seems to have been from Eufaula, Alabama. It also occurs at Prairie Bluff, Alabama. The figured specimen is in the collection of the American Museum of Natural History. Others are at Rutgers College.

Genus PROTOCARDIUM Beyrich.

Cardium (Protocardium) perelongatum, n. sp.

Plate XX, Figs. 20 and 21, and Pl. XXI, Figs. 4 and 5.

Comp. *Cardium Spillmani*, Conrad. Jour. A. N. Sci., 2d series, Vol. III, p. 326, Pl. XXXIV, Fig. 3. *Ibid.*, Vol. IV, p. 275 = *Lævicardium Spillmani* (Con.) Meek, Geol. Surv. N. J., 1868, p. 727.

Shell somewhat above a medium size, and very much elongated from beak to base, even in internal casts; the diameter in this direction being one-half greater than the antero-posterior diameter. Valves very ventricose, with strongly inflated umbones and strong, elevated, moderately incurved beaks, which are distinctly curved forward even in the cast. Hinge-line short, highly arched. Posterior side of the shell short and abrupt; the margin somewhat straightened. Anterior side rounded, but much shorter from the base of the shell to the hinge than the opposite side. Surface of the valves marked on the posterior side with strong rounded ribs, but apparently not extending quite to the crest of the umbonal ridge, the anterior side of the valve being marked only by irregular concentric striæ. Interior margin of the shell crenulate on the ribbed part of the valve, but apparently not beyond it. From the appearance of internal casts the cardinal teeth have not been particularly strong, but the laterals on the anterior side have been large and thick, with considerable height; postero-laterals somewhat smaller. Muscular imprints large. In one large specimen they are faintly marked, but in another smaller individual they have been quite deep on the anterior side. On the posterior side the shells seem to have been impressed from the margin of the imprints to near the beaks.

This shell is next to the largest species of Cardium known in the Cretaceous of New Jersey. The internal casts somewhat resemble those which I have referred to *C. Eufaulensis* Conrad, but they may be distinguished by the total absence of ribs on the central and anterior parts of the valve and by the want of crenulations left on the cast by the ribs along the junction of the valves; also by the curvature of the beaks toward the anterior side of the shell, whereas those of that species are straight. The inequality in the height of the anterior and posterior sides of the shell will also serve as a distinguishing mark. It is closely allied to *C.* (*Pachycardium*) *Spillmani* Conrad, from Tippah County, Mississippi, but I cannot think it is identical, as it answers neither to the description nor figure given of that species. The type of that species figured was badly crushed and distorted, but it shows very distinctly that it had been a broader shell, with broad, flattened ribs on the posterior side, which were separated by flattened interspaces of more than equal width. I have been unable to see an authentic specimen of *C. Spillmani* with which to compare it, however. This shell is not uncommon in New Jersey, and so far I never have found it labeled, except in the collection of the Academy of Natural Sciences of Philadelphia, where it is marked in Mr. Gabb's handwriting as "possibly not Spillmani." As both Mr. Gabb and Mr. Conrad frequently handled the specimens, I think had they considered it identical it would have been so marked. Still it is difficult to conceive why they did not describe it.

Formation and locality.—In the Lower Green Sands of the Cretaceous at Cream Ridge and Mullica Hill, New Jersey; and I have seen one very fine internal cast from Delaware.

Genus PACHYCARDIUM Conrad, 1870.

(Am. Jour. Conch., Vol. V, p. 96.)

Pachycardium Burlingtonense, n. sp.

Plate XXI, Figs. 6 and 7.

Shell large and extremely ventricose, with large, strong, prominent, and somewhat inflated beaks, which are strongly incurved and approximate. Valves inequilateral, the posterior side of the hinge line very much elevated, and the postero-cardinal portion of the valves somewhat lobed; height greater than the width; anterior side of the valves rounded from the hinge to the basal border; base regularly rounded, and the posterior side somewhat straightened. Surface marked on the umbonal slope and posterior side, extending to beyond the center of the valves by strong radii, those along the umbonal slope being the strongest and of more than an eighth of an inch in width on the type example. Other parts of the surface marked by concentric lines which do not appear to have been strongly marked. Hinge teeth very strong, their details cannot be determined from the specimen. Muscular scars very large and deeply marked, projecting on the cast, the posterior one largest.

This shell has been retained in the collection of the Academy of Natural Sciences at Philadelphia, under the name *C. Spillmani.* The shell is, however, quite different in many particulars. It is not so elongate by considerable, and the posterior side is distinctly lobed, and the form much higher on the shoulder. The surface is radiated as far as the middle of the valve, or beyond; although on the cast the markings are quite faint. In its short, broad form and high postero-cardinal margin it is strongly marked.

Formation and locality.—The specimen is marked with ink, on its surface, "N. Jersey," and has all the lithological features of specimens from near Burlington, New Jersey, being most likely from that place.

Genus FULVIA Grey, 1847.

Fulvia tenuis, n. sp.

Plate XX, Fig. 8.

Shell rather small, but little exceeding an inch in length by about half that height; transversely elliptical in outline, and but moderately convex. Beaks very small, appressed, and but very slightly projecting beyond the hinge margin. Anterior end of the shell the shortest, obtusely pointed, or sharply rounded at its extremity, which is situated much above the middle of the height; posterior end more broadly rounded; basal line strongly arcuate and rapidly ascending toward the anterior part. Hinge-line but little declining on either side of the beak. Surface of the valve marked by radiating plications which are very fine at the anterior end, and gradually increase in strength to the extreme posterior margin, where they must have been fully one-sixteenth of an inch wide (the shell being broken at this point). Plications flattened obliquely, so as to give the anterior side a much greater abruptness and only about one-third the width of the posterior side. A few concentric undulations mark the surface, and very fine concentric striæ cover the entire shell.

This is the first species of this section of the *Cardiidæ* which I remember to have seen from the Cretaceous formations. But I think there can be no doubt as to the correctness of the generic reference, although the hinge features are not observable. It has somewhat the appearance of a *Linearia* Conrad, but differs in its general form, and particularly so in the regular increase in strength of the striæ, which will readily distinguish it from specimens of that genus found in the New Jersey beds.

Formation and locality.—A single slightly imperfect valve (partial cast) occurs in the cabinet at Rutgers College, marked "Holmdel, Monmouth Co., N. J.," and had been labeled "*Pholadomya.*"

Genus FRAGUM Bolton.

Fragum tenuistriatum, n. sp.

Plate XX, Fig. 15.

Shell below a medium size, irregularly trapezoidal or sub-triangular in outline, highly ventricose and sharply angular along the posterior umbonal ridge, with a nearly vertical postero-cardinal slope. Beaks large, prominent and attenuated, projecting considerable above the hinge-line. Anterior side of the shell short and regularly rounded; posterior vertically truncate and the basal line oblique, being prolonged below toward the posterior umbonal angle. Surface marked, on the body of the shell at least, by very fine, semi-obsolete, radiating striæ, the posterior cardinal slope not showing evidences of striations on the cast, the only condition under which it has been observed. Hinge features unknown.

The shell has all the generic features of the genus *Fragum*, as far as can be determined from the external form, while the striations of the surface are much finer than is usually the case; but no ornamentation can be detected on the striations, and the features of the hinge are not visible. It is the only form of similar character yet known to me in the formations of the state.

Formation and locality.—In the lower micaceous clays beneath the Lower Marls, at the Rev. G. C. Schanck's pits, Marlborough, New Jersey. In Professor Lockwood's collection.

Genus LEIOPISTHA Meek.

Leiopistha protexta.

Plate XX, Figs. 1–3.

Cardium protextum Conrad. J. A. N. S., Phil., 2d ser., Vol. II, p. 275, pl. XXIV, Fig. 12.
Papyridea elegantula Gabb. Synop., p. 108. Not of Rœmer.
P. protexta (Conrad) Meek. Smith. Inst., Check-list, p. 12.
Leiopistha protexta (Con.) Meek. Geol. Rept. N. Jersey, 1868, p. 726.
Conrad. Geol. Rept. N. Car. (Kerr's), Append., p. 28.
Fragilia protexta Conrad. J. A. N. S., 2d ser., Vol. IV, p. 275.

Shell of moderate size, seldom attaining the length of one and one-fourth inches; broadly ovate in outline, with strongly inflated valves. Beaks large, prominent, enrolled, usually nearly in contact with each other at their apices, and situated but a little in advance of the middle of the length of the shell. Surface marked by about twenty-four or twenty-six radiating ribs in the larger individuals, with a small space on the posterior end of the shell apparently destitute of radii. In the casts the ribs are sharply defined, being somewhat angular on the crest, with rounded depressions between, and are of nearly equal strength on all parts in some individuals, while on others they gradually increase in number and fineness toward the anterior end.

This species may be readily distinguished from *L. inflata*, herein described, by its longer form, less inflated valves, smaller beaks, and strongly marked ribs. It differs from *L. elegantula* (*Cardium elegantula* Römer, Kreid. von Texas, p. 48, Pl. III, Fig. 5) in being a little more ventricose, with less distant ribs, and is without the broad flattened interspaces figured as existing in that species. Mr. Gabb, however, in his Synopsis cites them as identical.

Formation and locality.—In the Lower Green Marls at Holmdel, New Jersey, and also in the white limestone near that place. It also occurs at Burlington, New Jersey, at the same horizon. The species is also quite common in the white limestones of the Cretaceous at Prairie Bluff, Alabama. In the collection of the American Museum of Natural History in New York there is a shell from Eufaula, Alabama, which closely resembles this species, except that it has not been quite so much inflated, and the ribs are less prominent, while the posterior end of the shell is entirely destitute of radiating costæ for a much wider space than has been the case with the New Jersey specimen.

Leiopistha elegantula.

Not figured.

Cardium elegantula Rœmer. Kreid. von Texas, p. 48, Tab. V, Fig. 5.
Fragilia elegantula (Rœm.) Conrad. J. A. N. S., Phil., Vol. IV, p. 275.
Papyridea elegantula Gabb. Synopsis, pp. 106 and 162.

Mr. Conrad, in the Journal of the Academy of Natural Sciences, Philadelphia, 2d series, Vol. IV, p. 275, cites this species as coming from New Jersey, and gives it as one of the evidences of the synchronysm of the Tippah County, Mississippi, and Eufaula, Ala., beds with the Lower Green Marls of the New Jersey deposits. Among the specimens observed from New Jersey there are three distinct species of this group of shells, and of *L. protexta*, a variety possessing very much finer ribs than the normal form, the difference being very marked. But among them all I find no individual answering in character to that figured by Dr. Römer as above cited, and think it very doubtful if the species really occurs in the New Jersey beds.

Leiopistha inflata, n. sp.

Plate XX, Figs. 4 and 5.

Shell rather smaller than those of *L. protexta* Conrad, and very ventricose, with exceedingly large and inflated beaks, which are nearly central, very strongly incurved, and in close contact. Length of the shell only about one-fourth or one-fifth longer than high, and the thickness through the valves nearly or quite equaling the height. Anterior end but little shorter than the posterior, and more narrowly rounded. Surface of the casts marked by numerous low, nearly flattened, indistinct radii, which increase in fineness anteriorly, and are obsolete on the posterior cardinal slope.

This species is quite readily distinguished from *L. protexta* by its shorter and more ventricose form, more strongly inflated beaks, which are larger and much more prominent. The less strongly marked ribs is also a marked feature. It is not sufficiently near any of the other described species to be readily mistaken. It is most nearly allied in form to *L.* (*Papyridea*) *bella* Conrad (J. A. N. S., Phil., 2d ser., Vol. III, p. 326), but that one is described as having prominent angular ribs, which are tuberculated on some parts of the shell which these were not.

Formation and locality.—In the light-colored calcareous marls of the Lower Green Marls at Holmdel, New Jersey.

Genus CYMELLA Meek.

Cymella Meeki.

Plate XX, Figs. 6 and 7.

Cymella Meeki Whitf. Palæont. Black Hills, p. 418, Pl. XI, Figs. 27 and 28. Ext. p.

Shell of moderate size, transversely oval or ovate, about once and a half as long as high. Valves strongly convex, with large, somewhat prominent beaks, situated much nearer the anterior end. Shell nearly erect, and a little wider at the anterior end than behind. Extremities of the valves nearly equally rounded and the base regularly curved. Cardinal line long behind the beaks, and the margin inflected forming a narrow, linear, escutcheon-like area. Surface of the shell marked by strong and regularly rounded and regularly increasing undulations parallel to the border of the valves. These are crossed by distant radiating ribs, which are strong and vertical in the middle of the valve or opposite the beaks, and become gradually fainter and finer toward the posterior end, apparently becoming obsolete just below the cardinal border, and also before reaching the anterior cardinal margin. These radiating ribs, on the central parts of the shell especially, cut up the surface into rounded nodes by forming depressions across the concentric undulations. Surface of the shell and hinge-structure not seen, as the specimens are all in the condition of casts in a fine micaceous marl.

Mr. F. B. Meek, in his Invert. Pal. U. S. Geol. Surv. Territ., p. 237, cites this species as *Cymella bella* Conrad, Geol. Rept. North Carolina, Appendix, p. 10, Pl. II, Fig. 9. This, however, cannot be, as that species has the radii confined to the central portions of the valves, while in this one they extend over nearly or quite the entire shell. Mr. Conrad states in his description of *C. bella* that he had the shell itself under examination, which of course would possess the surface marking more completely than would a cast such as these found in New Jersey. These specimens, moreover, correspond in nearly all particulars with those from the Black Hills described in the report of that district. The genus *Cymella* appears to be very closely related to *Pholadomya*, and to possess nearly the characters of *Poromya* Forbes, with which Dr. Stoliczka seems to think is synonymous, while Mr. Conrad thinks it quite distinct. As I have not been able to see the hinge on any of the New Jersey specimens, I cannot give an opinion of its validity.

Locality and position.—In the fine micaceous marls or clays beneath the Lower Green Sands at Marlborough, Monmouth County, New Jersey, in the collection of the Rev. G. C. Schanck, and from the iron nodules from near Keyport, New Jersey, in the collection at Columbia College, New York.

CYPRINIDÆ.

Genus VENIELLA Stoliczka.

Veniella Conradi.

Plate XIX, Figs. 8–10.

Venilia Conradi Morton. Synopsis, p. 67, Pl. VIII, Figs. 1 and 2. Gabb, Synop., 177. Meek, Check-list, p. 13. Geol. Surv. N. J., 1868, p. 727.

Veniella Conradi (Mort.) Stoliczka. Pal. Indica, Vol. III, p. 190. Meek, Pal. Invert. Territ., p. 148.

Comp. *V.* (*Goniosoma*) *inflata* Con. Am. Jour. Conch., Vol. V, p. 44, Pl. I, fig. 10.

Com. *V. elevata* Con. Am. Jour. Conch., Vol. VI, p. 74, Pl. III, Fig. 7.

Shell, as found in New Jersey, small to medium size, but as found in Texas and neighboring States often quite large. Rhombic, trapezoidal or subquadrate in outline, very ventricose and sharply angular on the umbonal ridges, with large, prominent, incurved beaks, situated far interior and quite approximate. Hinge-line more or less curved and strongly bent beneath the beaks; posterior end truncate, showing a greater or less width in different individuals, often quite angular at the cardinal angle in younger shells, but more or less rounded in older specimens. Basal line gently curved and the anterior end obtusely rounded, longest below the center and largely excavated beneath the beaks, although but slightly projecting beyond them. Surface of the shell marked by strong concentric varices, which in the younger shells are broad concave furrows with sharp ridges, very distant and only three or four in number in medium sized individuals. In the older specimens these often become less marked, and in many of the Southern shells are nearly obsolete. The interior of the shell is seldom seen in the New Jersey marls, where it mostly exists as internal or partially external casts, but from the more Southern localities it is obtained preserving the substance of the shell and showing the hinge-features very distinctly.

The species is a strongly marked one, and is not easily confounded with but one other shell found in the New Jersey beds, namely, *Cardita decisa* Morton. From this one it may be distinguished by the presence of the surface undulations, the more angular umbonal ridge, more abrupt umbonal slope, and smaller and less enrolled beaks, which are more erect, those of that species being directed forward. There is a close resemblance between this shell and the *V. trigona* Gabb. Indeed they might quite readily be confounded, and may perhaps be identical; but the specimens referred to the latter species never show anything of the undulations of the surface so characteristic of *V. Conradi.* It is possible, however, that as all of those of *V. trigona* yet known are large, and have been much thickened shells, that these features would not have been retained on the internal casts. This fact might have been decided by an examination of the interior of Morton's type, but I did not succeed in finding it in the collection at Philadelphia, although Mr Meek appears to have had it in his hands, as he figures one in the Invert. Pal. of the Territories, p. 148, which he refers to as Morton's type, but which is much larger than Morton's figure. The shells described by Mr. Conrad as *V. inflata* and *V. elevata* may be only small or dwarfed specimens of this same species. They are, however, very ventricose, and bear the imprint of adult age, but are otherwise very similar. The beaks of both of those species are somewhat more erect and the posterior slope more abrupt, but this would still be the case in small shells where the form was similar to some of those which have been identified with this one without question.

Formation and localities.—The shell is present in the collections from the State from the Lower Green Sands at Holmdel, and from the micaceous clays under the lower bed at the Rev. G. C. Schanck's pits, near Marlborough, New Jersey. These show the strong undulations of the exterior, and are comparatively small specimens, retaining but little of the substance, being really *external* casts, and do not preserve any features of the interior.

Veniellia decisa.

Plate XIX, Figs. 15 and 16.

Cardita decisa Morton. Synopsis, p. 66, Pl. IX, Fig. 3.
Venilia Conradi Gabb. Synopsis, pp. 104 and 130 (not of Morton).

Shell of medium size, subquadrangular, rhomboidal or triangularly rhombic in outline, dependent more or less on compression or distortion of the valves. Valves usually very ventricose, with strong, rather inflated and enrolled beaks, situated near the anterior end and curved anteriorly, and strongly angular on the back; umbonal ridge distinctly and prominently angular, and highly arcuate in its passage from the beaks to the postero-basal angle of the valves. Cardinal border arcuate, the cardinal and basal margins subparallel and nearly equally curved; posterior margin squarely truncate below and sloping toward the hinge-line above; anterior end sharply rounded, and deeply excavated beneath the beaks. Postero-cardinal slope rather abrupt. Surface of the shell, as indicated on the casts, smooth or marked only by concentric lines of growth.

The external form of these casts is quite variable in different individuals, dependent to some extent on the degree and direction of the compression which they have undergone. This also affects more or less the ventricosity of the valves, which in their natural condition has been very great. I have seen no specimens yet which afford any of the hinge characters which will enable one to compare them satisfactorily with the recent species of the genus *Isocardia.* But there is one feature which exists on all the casts I have examined in which it differs from that genus, namely, a curved groove just in advance of the beaks in each valve, indicating a raised ridge on the inside of the shell, extending from beneath the beak to the under side of the hinge-plate analogous to that bordering the muscular imprint of *Cucullœa.* Should this prove to be the case in well-preserved individuals it would probably require generic separation, but the material which I have seen is too imperfect to warrant that step at the present stage of the investigation. The casts of this species have usually been referred to *Veniella Conradi* by collectors, but when compared with those of that species they are remarkably different. Dr. Morton's type specimen does not appear to be in existence; but from his figure I should judge it had been flattened by compression, thereby extending the beak and giving more than the usual amount of slope to the postero-cardinal border. The surface stria which he mentions, and which is faintly indicated on the figure, is most probably imaginary, at least no other specimen showing it appears to have been seen. Mr. Gabb, in his Synopsis, p. 104, in a foot-note under *Cardita decisa,* says Dr. Morton's type of the species is not to be found in the collection of the

Academy of Natural Sciences at Philadelphia, and he places the species as a synonym under *Veniella Conradi*, only from the evidence furnished by Dr. Morton's figure, still expressing a possibility, however, that it may be distinct.

Formation and locality.—In the Lower Green Marls at Blue-Ball, New Jersey, and at the marl pits of I. Stratton, near Mullica Hill, New Jersey. Dr. Morton's specimen was from the blue marls at Saint George's, Delaware.

Veniella inflata.

Plate XIX, figs. 4 and 5.

Goniosoma inflata Conrad. Am. Jour. Conch., Vol. V, p. 44, Pl. I, Fig. 10.
Comp. *V. elevata* Conrad. Am. Jour. Conch., Vol. VI, p. 74, Pl. III, Fig. 7.

Shell small, subquadrangular in outline, with inflated valves, and large, prominent, incurved beaks, which project considerably above the hinge-line, are rather erect and nearly centrally situated. Umbonal ridge sharply angular, and the postero-cardinal slope very abrupt and narrow. Anterior end of the shell sharply rounded, and the posterior squarely truncate, while the basal margin is broadly curved. The specimen, which is an internal cast, shows the muscular imprints rounded and strongly marked, and the pallial line distinct and simple. The hinge features show a strong triangular tooth beneath the beak in the left valve, and two smaller ones in the right, with an elongate lateral ridge in front on the right valve representing a ridge on the left valve. Surface of the shell unknown.

Mr. Conrad makes this shell the type of a new genus, *Goniosoma*, but there certainly is no feature about it in which it differs from the typical forms of *Veniella* as shown in *V. Conradi*, and as regards the specific features of the individual I can see no reason why it may not be identical with *V. elevata* Conrad. But as I have not seen any but the one type specimen of this, a cast, and no cast of *V. elevata*, unless this be one, I have hesitated to cite it as positively the same, although I believe it is. Dr. Stoliczka remarks that the form of this species is like *Veniella*, but considers, undoubtedly on Mr. Conrad's authority as given in his generic description, the hinge entirely distinct, which, I think, is an error; though for this

Mr. Conrad is responsible, as he gives a new name. His description of the genus *Goniosoma* is as follows: "An equivalve bivalve with prominent beaks and entire pallial line? the muscular impressions terminal, posterior one round; hinge (in the cast) with two prominent cardinal teeth, and a long anterior lateral tooth, parallel with the hinge margin above it in the right valve." The specimen does not show a ridge in the valve, but on the cast, which represents a ridge on the opposite or left valve. If any one will examine a valve of *Veniella Conradi* they will find these features all represented in the same manner.

Formation and locality.—In the Lower Green Marls at Crosswicks, New Jersey. Specimens borrowed from the cabinet of the Academy of Natural Sciences of Philadelphia.

Veniella elevata.

Plate XIX, Figs. 6 and 7.

Venilia elevata Conrad. Am. Jour. Conch., Vol. VI, p. 74, Pl. III, Fig. 7.
Comp. *Veniella* (*Goniosoma*) *inflata* Con. sp. Am. J. Conch., Vol. V, p. 44, Pl. I, Fg. 10.

Shell very small and extremely ventricose, subquadrangular in outline, with large, prominent, incurved beaks, very angular umbonal ridge, almost vertical postero-cardinal slope, and rounded anterior margin, which curves regularly into the basal line; posterior end almost vertically truncate. Surface of the shell marked by four distant, elevated, concentric lamellæ, which project nearly at right angles to the surface of the shell from which they originate, the one nearest to the beak being small and inconspicuous. Internal features not seen.

A single valve only of this species has been observed, it being the typical one figured by Mr. Conrad, *loc. cit.*, and from which in all probability the profile view of both valves was also made by restoration. The species is almost, if not quite, identical with *V.* (*Goniosoma*) *inflata* of the same author, but preserves the shell, while that one is described from an internal cast, thus presenting different characters. This one, however, is smaller, but still fully as ventricose as that one, showing it to be an adult shell. They both very closely resemble and appear to be dwarfed specimens of a form which I have considered as *V. Conradi* Morton, but which differs materially in its surface character from those of that species, as identified by various authors, from other and more southern localities, but not from Dr. Morton's figured specimen, which was from Arneytown, N. J., but which shows the concentric sulci much less strongly developed than those to which I refer. I am much inclined to think they are all of one species, however, and that this one and *V. inflata* are merely dwarfed individuals. In some of the New Jersey examples, which are internal casts, the sulci of the surface are preseved to their fullest extent, while on other casts they are entirely obliterated. This seems to have arisen from different conditions of preservation, and from a difference in the material of the filling and matrix.

Formation and locality.—In the micaceous clays below the Lower Marls at Haddonfield, New Jersey. From the collection of the Academy of Natural Sciences at Philadelphia.

Veniella trigona.

Plate XIX, Figs. 11–14.

Venilia trigona Gabb. P. A. N. Sci., Phil., 1861, p. 324. Synopsis, Meek, Check-list, p. 13. Geol. Surv. N. J., 1868, p. 726.

The type specimen of this species, an internal cast, represents an extremely ventricose shell of a trapezoidal or subtriangular outline profoundly angular on the umbonal ridge, and with large, prominent, incurved and rather distant beaks. Posterior end narrow and nearly at right angles with the posterior third of the basal line. The latter border of the shell is strongly rounded upwards on the interior half and merges gradually into the anterior margin. Hinge-line sharply bent beneath the beaks, and the hinge appears to have been characterized by strong teeth on the anterior of the plate. Cardinal slope very abrupt and nearly vertical, giving a nearly flattened postero-cardinal surface to the cast extending to the umbonal angles above the position of the muscular scars. Muscular scars very strong and prominent on the cast, the posterior ones large, and on the type are followed by a ridge for some distance toward the beaks. A second cast shows a somewhat less triangular form, with a broader posterior end and not quite such ventricose valves. This species represents very well some of the more ventricose forms, which are usually referred to *V. Conradi*, from Alabama and Texas, and which, although usually more or less marked with strong varices externally, do not retain them on the internal casts. In this respect they differ very materially from the New Jersey forms of that species, which have the three or more very strong undulations of the exterior equally well marked on the casts, while these specimens are entirely destitute of this feature, for which reason I am inclined to think they really represent, with the southern forms above mentioned, an entirely distinct species from *V. Conradi*. Dr. Morton included both forms under the one designation, but his figured specimens I believe were from New Jersey, although the types themselves are not now to be found.

Formation and locality.—The type specimen is given by Mr. Gabb as from Boonton, New Jersey. The second specimen mentioned above is marked on the label as from Monmouth County. I have seen other fragments from Freehold.

Veniella subovalis, Con.

Plate XIX, Figs. 1 and 2.

Venilia subovalis Conrad, on label in collection of the Acad. Nat. Sci., Philadelphia.

Shell below a medium size, transversely subovate or subtrapezoidal in outline, about once and a half as long as high, with subparallel dorsal and basal margins. Beaks rather strong, but not very prominent, not projecting much above the cardinal line, directed anteriorly and closely approximate, situated at about the anterior third of the length of the shell. Anterior end of the shell pointedly rounded, and the posterior end somewhat squarely truncate or very broadly rounded, almost direct. Disk of the valves ventricose and sharply angular along the umbonal ridge, leaving a decided angulation on the cast, most distinctly so in the upper part. Surface of the shell unknown. Interior of the right valve, as obtained on a gutta-percha imprint taken from the cast figured, with a rather broad hinge-plate and strongly marked muscular imprints of proportionally large size.

The hinge-plate is characterized by two cardinal teeth, widely divergent, with a deep triangular pit between, and the posterior tooth grooved on its surface, a short anterior pit and a long lateral groove behind, which is vertically crenulate on the sides.

The species differs from any other of the genus in its transverse form, small beaks, and less ventricose valves. I find the specimens labeled *Venilia subovalis* Conrad, in Mr. Conrad's own handwriting, but have not been able to find any published description or mention of the name in print. Mr. Conrad does not mention it in his enumeration of the species in 1866, in the Am. Jour. Conch., Vol. II, p. 103; nor is it mentioned by Mr. Gabb or Mr. Meek in catalogues, or by Dr. Stoliczka in the Palæont. Indica. It is possible I may have overlooked it in some of Mr. Conrad's later publications; therefore I have adopted the name used by him on the label.

Formation and locality.—In the Lower Marls at Crosswicks, New Jersey. From the collection of the Academy of Natural Sciences at Philadelphia.

Veniella trapezoidea.

Plate XIX, Fig. 3.

Venilia trapezoidea Conrad. J. A. N. S., 2d ser., Vol. IV, p. 282, Pl. XLVII, Fig. 7. Gabb, Syn. Cret. Form., p. 178. Meek, Check-list Smith. Inst., p. 13.
Veniella trapezoidea (Con.) Stoliczka. Pal. Indica, Vol. III, p. 189.

Shell rather small, trapezoidal in form, but often subtriangular, as seen in internal casts. Valves moderately ventricose, with moderately strong beaks, situated near the anterior third of the length. Hinge short, very slightly arcuate, the margins inflected, forming a slight escutcheon. Anterior side of the beaks contracted, throwing the anterior extremity of the shell below the median line, and giving it a narrowly rounded form; basal line gently arcuate, and the posterior margin obliquely truncate, much shortened above and leaving the postero-basal angle somewhat pointed. A strong angular umbonal ridge extends from the beak to the basal angle, giving an abruptly sloping form to the postero-cardinal portion of the shell. Surface marked by concentric lines and by one or more stronger varices of growth.

The more transverse form of this shell at once distinguishes it from *V. Conradi* Morton, as well as from most of the other species found in New Jersey.

Locality.—The only specimen of this species which I have seen from New Jersey is from the Lower Green Marls at Holmdel.

Genus SPHÆRIOLA Stoliczka.

Sphæriola umbonata.

Plate XIX, Figs. 17 and 18.

Shell moderately large and very ventricose, with very full, prominent beaks and umbones, which are situated considerably anterior to the middle of the length of the shell. Anterior end of the shell more broadly rounded than the posterior, and the basal line very slightly flattened in the middle. Surface of the cast marked by strong concentric lines, and by a few distant undulations of the surface. Ligament strong and prominent. Further hinge characters unknown.

Only a single very imperfect cast of this species has been obtained, the condition of preservation of which is such as to render a more complete description of its character impossible. It differs from any of the species from the upper Missouri region in being more inequilateral, and in the inflated character of the beaks, which are remarkably strong. The specimen was observed among the collections of the Academy of Natural Sciences at Philadelphia, marked *Arca antrosa.* As it is the only individual of the genus yet recognized on the Atlantic border, I have concluded to name it, for the purpose of calling attention to it, notwithstanding its very imperfect condition.

Formation and locality.—The specimen is marked simply "Cret., N. J.," without clue to its definite locality, like so many of the specimens formerly used, and probably collected or deposited in the collection by Messrs. Conrad and Gabb; through which error the great interest of the specimens is entirely lost to science and their principal uses destroyed. The specimen is a cast in coarse greensand, coated with a blackish deposit of decayed vegetable matter, and I infer it may have come from the Lower Beds of the Cretaceous.

Suborder SINUOPALLIATA.

VENERIDÆ.

Genus CALLISTA Poli.

Callista Delawarensis.

Plate XXII, Figs. 8–10.

Dione Delawarensis Gabb. J. A. N. S., Phil., 2d ser., Vol. IV, p. 302, Pl. XLVIII, Fig. 18.
Callista Delawarensis Gabb. Synop., p. 105.
Dione Delawarensis (Gabb) Meek. Smithson. Check-list, p. 13. Stoliczka, Pal. Indica, Vol. III, 165.
Comp. *Venus Ripleyana* Gabb. J. A. N. S., new ser., Vol. IV, p. 393, Pl. LXVIII, Fig. 22.
Not *Caryates Delawarensis* (Gabb) Conrad. Am. Jour. Conch., Vol. V, p. 41, Pl. I, Fig. 6.

Shell of moderate size, slightly transverse, with the beaks anterior to the middle, small and but little incurved. Outline ovate, broadest opposite the beaks and somewhat pointed posteriorly. On the casts the teeth are small, the muscular imprints rather large and moderately distinct, and the pallial line deeply and rather broadly sinuate; the sinus rounded at the extremity and directed forward and upward. Only small shells preserving the substance have been observed. They have the same general form with the casts, while the surface is marked by very regular, gradually increasing, concentric ridges parallel to the margin, and are flattened on the surfaces and separated by deep, sharp, but narrow grooves.

The cast of this species are not easily distinguished from those of one or two other species, and especially from casts from the Eocene sands of the upper marl beds at Farmingdale, N. J. It may be said to differ in that one being longer in front than behind the beaks, and from what evidence can be obtained from the casts, also in the surface characters, as that one appears to have been marked only by fine concentric lines of growth instead of the regular ridges of this one. From *C. veta*, Conrad, it differs in being a larger shell and proportionally less ventricose, as seen in the casts. From some of the Eocene casts I cannot see distinguishing features. I see no reason, so far as I can judge from the description and figure given by Mr. Gabb, to suppose his *Venus Ripleyana*, Jour. Am. Sci. Phil., new series, Vol. IV, p. 393, Pl. LXVIII, Fig. 22, is distinct from this one. The form is said to be proportionally shorter and more pointed posteriorly and the surface ribs coarser and less regular. Among the specimens from Holmdel and Marlborough examples may be selected which will more than cover all these differences.

In regard to the generic affinities of the shell, I can see no reason for separating these Cretaceous forms from those found in the Eocene; in fact, I think those of the New Jersey Eocene are, most likely, specifically identical. Certainly I should not think of classing them under a different genus simply because they were found in a different geological formation, and that only, as do some authors, for I cannot believe in limiting zoological groups by geological formations.

Formation and locality.—As casts only in the Lower Green Marls at Freehold, New Jersey, and as small shells from the nodules in the Lower Marls at Marlborough and Holmdel, New Jersey. Mr. Gabb cites it from the Delaware and Chesapeake Canal and New Jersey.

Genus APHRODINA Conrad. 1868.

(Am. Jour. Conch., Vol. IV, p. 246.)

Aphrodina Tippana.

Plate XXII, Figs. 6 and 7.

Meretrix Tippana Conrad. Jour. A. N. Sci. Phil., new series, Vol. III, p. 326, Pl. XXXIV, Fig. 18. Gabb, Synopsis, p. 142.
Dione Tippana (Con.) Meek. Check-list, p. 13.
Aphrodina Tippana Conrad. Am. Jour. Conch., Vol. IV, p. 246, Pl. XVIII, Fig. 5. Meek, Geol. Surv. N. J., 1868, p. 727.

Shell of moderate size, transversely ovate or subtriangular in outline, with moderately convex valves and prominent subtumid beaks, which are nearly subcentrally situated and slightly directed forward. Anterior end of the valves broadly rounded and the posterior end more pointed; the greatest length of each situated rather below the middle of the height. Base broadly curved and the postero-cardinal margin rapidly sloping, with a moderate degree of arcuation, to the posterior extremity. Casts show the muscular imprints to be very faintly marked but of tolerable size, and the pallial sinus broad, deep, and obtusely pointed.

I have only seen casts of this species, so that the hinge structure is not known to me. Mr. Conrad mentions in his generic description of *Aphrodina*, of which this species is the type, that he has a single perfect left valve showing the hinge characters, which he describes as follows: "Hinge in the left valve with three diverging cardinal teeth, the anterior tooth as thick as the middle one or thicker, and a straight, compressed, transversely rugose lateral tooth parallel with the margin of the shell above it." I have not seen the shell spoken of, and cannot judge of its merits more than is shown by the figure he gives, which is copied on our plate. The species does not appear to be abundant, and among the few which I have been able to refer to it there is considerable variation in form, which is perhaps, to some extent, due to compression and distortion in the marls. The surface of the shell, so far as I can judge, appears to have been marked with fine concentric lines only. Mr. Conrad's specimen, which was from Tippah County, Mississippi, seems to have been not so high as others found in the collection of the Academy of Natural Sciences labeled *Meretrix Tippana?* in his handwriting, and the locality New Jersey. Dr. Stoliczka appears to think there was little reason for separating the shell as a generic type, and considers it as equivalent to *Caryatis* of Roemer, but has only seen the description of Mr. Conrad. In its general form it differs from *Callista Delawarensis* in being more elevated, which causes a more triangular form of outline with more nearly subcentral beaks. It is also of larger size as a general thing.

Formation and locality.—In the Lower Green Marls at the deep cut of the Holmdel and Keyport turnpike, Monmouth County, New Jersey, and in the micaceous clays below the Lower Marl at the Rev. G. C. Schanck's pits, Marlborough, and from Cream Ridge, New Jersey. One of the specimens from the Academy of Natural Sciences collection appears to have come from the first locality also, the other having the appearance of coming from the limestone nodules of the Lower Marls. A specimen of nearly the same form, but a little doubtful, is from Freehold, New Jersey.

Genus CYPRIMERIA Conrad. 1864.

(Proc. Acad. Nat. Sci. Phil., p. 212.)

Cyprimeria depressa.

Plate XXII, Figs. 11–13.

Dosinia depressa Conrad. J. A. N. S. Phil., new ser., Vol. IV, p. 278, Pl. XLVI, Fig. 6.
? *Sanguinolaria cretacea* Con. J. A. N. S., new ser., Vol. IV, p. 277, Pl. XLVI, Fig. 11. Gabb, Proc. A. N. S., 1876, p. 308.
Dosinia Haddonfieldensis Lea. P. A. N. S., 1861, p. 149.
D. depressa (Con.) Gabb. Synopsis, p. 120. Meek, Check-list, p. 13.
Cyprimeria Cretacensis Conrad. Am. J. Conch., Vol. III, p. 9.
C. Cretacea Con. Am. J. Conch., Vol. II, p. 102.
C. depressa Conrad. Kerr's Rept. Geol. Surv. N. Car., Appendix, p. 9.
C. depressa (Con.) Gabb. P. A. N. S., 1876, p. 308.

Shell of medium size, transversely broad-ovate in outline, with very depressed convex valves, which are broadest anteriorly and somewhat subcuneate behind, although slightly truncate at the narrow extremity. Beaks very small, inconspicuous, situated a little nearest the anterior end of the valve, and pointed. Postero-cardinal margin rapidly sloping from the beaks to the posterior truncation, and but very little arched in its course; more so on the left valve, and almost invariably a little humped at about one-third of the length behind the beak on the right valve. Basal line strongly rounded, fullest just in advance of the middle. Right valve the most convex and bent downward at the posterior, while the left valve is curved or bent upward to correspond, giving a rather strong twist to the valves as seen in a basal view. Surface of the shell marked by regular concentric lines of growth and numerous stronger varices at irregular distances. Near the apex of nearly all valves the surface is marked by regular concentric ridges when seen under a glass, which are lost at from a fourth to three-eighths of an inch from the beaks. When the valves are united the lunular depression is but slight, but behind the beaks the margins of the valves are strongly inflected and form a deeply excavated escutcheon, like that of *Circe*, while the beaks of the two valves nearly touch each other. In the interior the hinge-plate is rather wide, the muscular imprints faintly marked but large, and the pallial line quite distinct but not sinuate.

Internal casts of the species appear to be comparatively rare, at least in a condition to be identified. On them the beaks seem to be much larger, and to have a greater excavation in front than the shell would indicate: This is the result of a thickening which takes place opposite the beaks in the shell, leaving the hinge-plate shelving more behind it, which produces the beak in the casts further back.

In the collection of the Academy of Natural Sciences of Philadelphia the specimens which are marked in Mr. Conrad's handwriting *Cyprimeria Cretacea* appear to be positively identical with those marked as of this species. I have therefore cited that species as a synonym of this one, although the original figure given in Vol. II, Journal Academy of Natural Sciences, new series, Pl. XLVI, Fig. 11, would appear to be somewhat more elongated than any of the specimens which I have seen.

In regard to the generic relations of this shell there may not be any real doubt, but it is quite certain that the pallial sinus is obsolete. Nor can I say with certainty that I have seen a pallial sinus on any species from New Jersey which has been referred to this genus, although it is usually described as possessing such a feature, and is referred to a family which is supposed to be composed of sinuopallial shells. The entire expression of this shell in the interior is more that of an *Astarta* than of a *Tellina*, only for the bending of the valves.

Formation and locality.—The shells which I have used, and which belong to the Academy of Natural Sciences of Philadelphia, are from the micaceous clays of the Lower Marls at Haddonfield, New Jersey. The cast which I have figured is from Freehold, New Jersey, and is from the collection of the American Museum of Natural History, New York City.

Cyprimeria densata.

Plate XXII, Figs. 19–21.

Tellina densata Conrad. J. A. N. Sci., Phil., 2d ser., Vol. II, p. 275, Pl. XXIV, Fig. 14.
Dosinia densata (Con.) Gabb. Synopsis, p. 120. Meek, Check-list, p. 13.
D. donata (Con.) [by error for *D. deusata*] Meek. Geol. Surv. N. J., 1868, p. 727.
Cyprimeria densata Conrad. Am. Jour. Conch., Vol. II, p. 102.
Not *Dosinia densata* Conrad. J. A. N. S. Phil., 2d ser., Vol. III, p. 725, Pl. XXXIV, Fig. 13 (=*C. alta* Con. Kerr's Rept. Geol. N. C., Appendix, p. 27).

Shell large, transversely elliptical, with the posterior end broadly and squarely truncate. Valves moderately convex, the right more prominently so, and about three-fourths as high as long. Beaks small, appressed, situated behind the anterior third of the length; a slight umbonal angulation marks the posterior slope, between which and the cardinal margin the surface of the shell is flattened, corresponding to the truncation of the posterior end of the shell. Surface of the shell marked by somewhat regular concentric striæ, which are abruptly bent at the umbonal ridge and pass direct nearly to the cardinal margin.

I have seen several imperfect examples of the casts of this shell from New Jersey, but no perfect ones. The species attains a rather large size, Mr. Conrad's example of the species being more than three and three-fourths inches long by two and a half inches high. No examples which I have seen furnish any evidence of the hinge characters, but the general expression of the partial casts is much like that of a species of *Dosinia*, from which genus the distinct inequality and twisting of the valves would serve to distinguish it. Mr. Conrad states in his description that the right valve is convex and the left one flat. In the specimen which he used and figured, and which is now before me, the left valve is about half as convex as the right one, and both are decidedly bent or twisted near the posterior end, as are those of many of the divisions of the *Tellinidæ*. In the general expression of the cast there is no feature to distinguish it from a cast of a large *Sanguinolaria*.

The species differs from those which I have referred to *C. excavata*, Morton's sp., in the less inequality of the valves, and more decidedly so in the marked truncation of the posterior extremity at right angles to the axis of the shell; also in the angulation of the umbonal ridge, as well as in being much more transverse.

Formation and locality.—In the Lower Marls at Holmdel, New Jersey, in collections obtained from the Rev. Dr. Riley, and from Burlington, New Jersey, as marked on the specimen originally used by Mr. Conrad. I have also seen specimens which, judging from the lithological characters, must have come from several different localities, but which were not indicated.

Cyprimeria excavata.

Plate XXII, Figs. 16 and 17.

Cytherea excavata Morton. Synopsis, p. 67, Pl. V, Fig. 1.
Dosinia excavata (Mort.) Gabb. Synopsis, p. 120. Meek, Check-list, p. 13. Conrad, P. A. N. Sci. Phil., Vol. VI, p. 320.
D. densata Conrad. J. A. N. Sci. Phil., 2d ser., Vol. III, p. 325, Pl. XXXIV, Fig. 13 (=*Cyprimeria alta* Con. Kerr's Geol. N. C., Appendix, p. 27.)
Not *Dosinia donata* (Con.) Meek (by error for *D. densata*). Geol. Surv. N. J., 1868, p. 727.
Cyprimeria excavata (Morton) Conrad. Am. Jour. Conch., Vol. II, p. 102. Meek, Geol. Surv. N. J., 1868, p. 727.

Shell, as shown by internal casts, of medium size, transversely or triangularly subcircular in outline, with distinctly unequal valves, the right being prominently convex on the umbone and the left depressed convex, becoming concave toward the front from the twisting of the valves, and marked along the posterior slope by a faint plicature or depressed sulcus. Beak small and appressed, curved anteriorly and subcentrally situated, the anterior side somewhat excavated or concave, cardinal margin arcuate, and the borders of the valves generally curved. Surface of the shell, as far as can be judged from the casts, marked by concentric lines.

The casts which I have referred to this species are more circular than those pertaining to *A. densata* Conrad, and of smaller size and decidedly shorter, with more erect beaks, and apparently more unequally convex valves, which show no evidence of the distinctly flattened postero-cardinal slope. No evidence of hinge characters remain on any of the few specimens which I have examined, but the unequal valves, together with the apparent bending or twisting of the basal portions, would seem to place them at once among this group of shells. From their highly imperfect conditions, however, no satisfactory proof of generic relations can be obtained. Dr. Morton's figure is much more triangular in outline than any specimen which I have seen. It is probable that he intended to include under his species all those from the New Jersey Cretaceous now known under the several names used. His description is, however, so very vague, that it is impossible from it to decide which of these forms he had under consideration. So we must depend entirely on his figure, which is but little more satisfactory than the description. I have therefore retained for his species the form which is most erect, as corresponding most nearly to it. In this respect it is most nearly allied to *C. spissa* Conrad, although that one is longer in an antero-posterior direction than any of the specimens referred to *C. excavata.*

Formation and locality.—In the Lower Green Marls at Holmdel and elsewhere in Monmouth County, New Jersey. Dr. Morton's specimen was from Arneytown, New Jersey.

Cyprimeria Heilprini, n. sp.

Plate XXII, Figs. 14 and 15.

Shell of medium size, transversely elliptical in outline, and very decidedly inequivalve, but nearly equilateral, as seen in the condition of internal casts. Beaks prominent and nearly or quite central. Right valve much the most convex, and the left concave toward the front, giving a decided curvature to the basal line as seen on the edge of the cast. Muscular scars large and well marked; no pallial sinus. The hinge-plate has been quite thick, and the teeth large and strong, as evinced by the broad depression along the cardinal line of the cast. Surface features unknown.

This species has somewhat the external form of *C. appressa* Conrad, but has been a much deeper or more ventricose shell, with proportionally more elevated and prominent beaks. It is also somewhat related in form to *C. densata*, but is proportionally more transverse and more equilateral than any specimen of that species observed. Although I have seen but a single individual cast of it, the features are so marked and prominent, that I have not hesitated to describe it as a distinct form.

Formation and locality.—In the lower beds of the Lower Green Marls at Crosswicks, New Jersey. From the collection of the Academy of Natural Sciences of Philadelphia.

Cyprimeria spissa.

Plate XXII, Fig. 18.

Cyprimeria spissa Conrad. Am. Jour. Conch., Vol. V, p. 44, Pl. I, Fig. 9.

The specimen figured in this report is the only one which I have seen that will in any degree correspond to the figure given by Mr. Conrad of his

C. spissa, and there is considerable difference between them even then; but it is impossible in the absence of his type specimen to say how imperfect it may have been or how near the figure may represent it. In this latter respect, however, it is only fair to say that in general features his figures are very expressive. The cast which I have figured and referred to the species is oblately circular in outline, a little wider than high, with a small apex, rather prominently convex disk, and with a posterior constricting furrow in the line of the advancement of the muscular scar which is less distinctly marked than on his figure, and the pallial line is also not so marked. The posterior scar is distinct, of a large size, while the anterior is scarcely visible. The shell lacks the angular anterior end, and is much wider posteriorly than Mr. Conrad's figure. Still, I am strongly inclined to believe it belongs to the same species. They both present much the appearance of specimens of *Lucina* rather than *Cyprimeria*, but the one here described may readily be imagined to have been twisted in an antero-posterior direction.

Formation and locality.—Mr. Conrad's specimen was from Crosswicks, New Jersey, while the one here used is from the Lower Marls at Holmdel, Monmouth County, New Jersey, and is from the collections of the Rev. Dr. Riley.

Genus DOSINIA Scopoli.

Dosinia Gabbi, n. sp.

Plate XXII, Figs. 4 and 5.

Shell of medium size, not exceeding one and one-eighth inches in its greatest diameter, subcircular in outline and moderately gibbous, with projecting beaks, which are directed forward and slightly incurved. On the internal cast there are evidences of two cardinal teeth in each valve, but none of any laterals. The muscular imprints are large and but faintly marked, and the pallial line is deeply sinuate; the sinus deep and angular and directed upward and forward. The cardinal margin is deeply inflected as if for a wide hinge plate or ligament, and the edges of the depression sharply angular. The surface of the cast bears evidence of strong concentric undulations on the outer half of the shell. Some imperfect valves preserving the shell, which I suppose to be one of the same species, have the same general form, with very thin shells, smooth or only marked with fine concentric lines and occasional varices of growth, all are imperfect at the beaks and hinges. The cardinal margins are very sharply and deeply inflected, but none of the hinge features are preserved so as to be determined.

I find no description or figure answering to this species. The specimen used for illustration I found in the cabinet at Rutgers College, marked "*Mysia gibbosa* Gabb" in what was supposed to be Mr. Gabb's own handwriting. But the specimen differs very materially from Mr. Gabb's figure cited under *Tenea pinguis* Con., and also from the specimens which I have referred to that species, in being much less gibbous, less erect, rather more transverse, and in having the postero-cardinal margin in the cast even more strongly inflected. The shell is, I think, as nearly a true *Dosinia* as any found in the Cretaceous formation, and certainly does not belong to the genus *Mysia* Leach, as it has a deeply sinuate pallial line, which that genus does not admit, and it appears to possess all the requisite features of *Dosinia* so far as they can be made out.

Formation and locality.—In the Lower Green Marls at Burlington and Freehold, New Jersey, received, as indicated on the labels, from S. J. Germain and D. Bishop; also in the cabinet of the American Museum of Natural History. The specimen preserving the shell, identified as the same with the casts, are from Upper Freehold, New Jersey, from collections made by Dr. Bruere.

Dosinia ? erecta, n. sp.

Plate XVIII, Figs. 17–20.

Shell small, less than an inch in height, and quite erect, being nearly equilateral and ovate in outline, the widest part opposite or below the middle, with appressed valves, most gibbous near the umbones, the beaks small, erect, and moderately approximate. Cardinal margins of the valves strongly and sharply inflected, most strongly and largely so on the anterior side. Surface of the valves marked only by fine irregular concentric lines of growth, and the substance very thin and fragile. Hinge characters unknown. Muscular imprints small and obscure, and the pallial line unknown.

The shell somewhat closely resembles *Dosinia Gabbi*, herein described, in the delicacy of the valves and the inflection of the cardinal margins, but is quite distinct in the form of the outline, that one being broader, rounder, and less erect. There may be considerable doubt as to the generic relations of this species, as none of the generic features have been clearly ascertained, and the reference is made entirely from the external appearances of a few shells destitute of the most of the cardinal portions, and one internal cast, on which the markings are so faint as not to be considered reliable.

Formations and localities.—From the Lower Green Marls at Upper Freehold, New Jersey, and from near Marshallville, New Jersey.

Genus TENEA Conrad. 1871.

(Am. Jour. Conch., Vol. VI, p. 72.)

Tenea pinguis.

Plate XXII, Figs. 1-3.

Lucina pinguis Conrad. J. A. N. Sci., Phil., new ser., Vol. II, p. 275, Pl. XXIV, Fig. 18.
L, pinguis (Con.) Meek. Check-list, p. 12; Geol. Surv. N. J., 1868, p. 726. Gabb, Synopsis, p. 138.
Diplodonta parilis Conrad. J. A. N. Sci., Vol. IV, p. 278, Pl. XLVIII, Fig. 16 (by error given Fig. 8 in text, p. 278).
Mysia gibbosa Gabb. J. A. N. Sci., Vol. IV, p. 302, Pl. XLVIII, Fig. 17 (not fig. 18).
Tenea parilis Conrad. Jour. Am. Conch., Vol. VI, p. 73, Pl. III, Fig. 12. Kerr's Geol. Rept. N. C, p. 8, Appendix, Pl. II, Fig. 25.
T. pinguis (Conrad) Gabb. P. A. N. S., 1876, p. 307.

Specimens of small size. Casts nearly circular in outline, but a little higher than long. Valves very gibbous, inflated on the umbones. Beaks large and elevated, rather strong, incurved forward; cardinal line arcuate behind and excavated in front of the beaks. On the posterior side the cardinal border is deeply sunken, showing the existence of a rather wide or inflated hinge plate. Muscular scars rather large and but faintly marked; pallial line deeply and angularly sinuate, the sinus directed upward, pointing nearly toward the apex of the cast.

The specimens which preserve the shell, and used by Mr. Conrad as the types of the genus *Tenea*, are smaller than most of the casts observed. The surface is comparatively smooth, or marked only by fine concentric lines of growth. On them the posteror-cardinal margin is seen to be slightly inflected, but the front is thin and sharp, showing not the least tendency to form a lunule. The specimens, some of which are partial casts, do not show the pallial sinus very distinctly, but faint indications of it can be traced among the lines caused by fractures in the shell. The hinge features show the V-shaped tooth beneath the beak described, with an elongate depression in front and an oblique elongate ridge behind it in the left valve, and the right valve shows evidence of a bifid tooth beneath the beak, with a very narrow posterior tooth behind. From these characters it will be seen that the shell belongs to the *Dosininæ* and not to the *Ungulinidæ*, as placed by some authors; but the general features of the shell are so nearly those of *Thetis* Sowerby that there would hardly seem any necessity of forming a new genus for it. As several authors have, however, preferred to adopt *Tenea*, I have retained it under that designation.

Formation and localities.—Found in the micaceous clay at the base of the Lower Marls at Haddonfield, Mr. Conrad's types of *T. parilis*. It also occurs at Holmdel, Upper Freehold, near Burlington, and at Freehold, New Jersey. It is also found in Delaware, and I cannot distinguish between these casts and many of those of the same form which occur in the Eocene layers of the Upper Green Sands at Farmingdale, Shark River, and near New Egypt, New Jersey.

TELLINIDÆ.

Genus TELLIMERA Conrad, 1871.

(Am. Jour. Conch., Vol. VI, p. 73.)

Tellimera eborea.

Plate XXIII, Figs. 12 and 13.

Tellina (*Tellinimera*) *eborea* Conrad. J. A. N. Sci., new ser., Vol. IV, p. 278, Pl. XLVI, fig. 14. Meek, Check-list, p. 14.
T. eborea (Conrad) Gabb. Synopsis, p. 173.
Tellimera eborea Conrad. Am. Jour. Conch., Vol. VI, p. 73.

Shell small; the largest specimen used measuring only about eleven-sixteenths of an inch in length. Form triangularly ovate or subtriangular and very depressed convex. Beak small, appressed, and situated considerably nearer to the posterior end. Anterior end rounded, gradually sloping from the beak to near the point of greatest length; basal margin broadly curved, and the posterior end truncate below, and obliquely sloping, with a slight convex curvature, from the beaks to the postero-cardinal angle. Postero-umbonal slope flattened, and marked by a very faint angulation of the surface. Surface of the shell marked by fine but regular, increasing, flattened, concentric ridges, which are separated by narrow impressed lines, and are abruptly bent upward in crossing the umbonal ridge.

The shells are all broken at the apex and along the postero-cardinal margin, so that the hinge features are not perfectly seen. I have drawn a figure of them of about twice the natural size, as well as I can make them out. The characters are so very obscure that I shall not undertake to discuss their relations from what I can see of them. Dr. Stoliczka in speaking of it considers it as very closely related to the genus *Angulus*, another division of the *Tellinidæ*, but the specimens which I have seen do not afford material for comparison.

Formation and locality.—Mr. Conrad's types were from Alabama. The specimens used in the above description are marked Haddonfield, New Jersey, and are borrowed from the collection of the Academy of Natural Sciences, Philadelphia. They are much smaller than that figured by Mr. Conrad. There are some internal casts from the micaceous clays beneath the Lower Marls at the Rev. G. C. Schanck's pits near Marlborough, New Jersey, which I have referred to the same species, as they have the same form and a few of the surface markings, but they show none of the internal features.

Genus LINEARIA Conrad, 1871.

(Am. Jour. Conch., Vol. VI, p. 73.)

Linearia metastriata.

Plate XXIII, Figs. 6 and 7.

Linearia metastriata Conrad. J. A. N. Sci., new ser., Vol. IV, p. 279, Pl. XLVI, Fig. 7. Gabb, Synopsis, p. 137. Meek, Check-list, p. 14. Also as generic illustration, Am. Jour. Conch., Vol. VI, pp. 73 and 74, Pl. III, Fig. 11.

Shell small, the largest individual seen (a cast) measures a little more than an inch in its transverse diameter. Form of the shell broadly and quite regularly transversely ovate, widest across the anterior end, with very small, appressed beaks, but slightly rising above the hinge margin and almost centrally situated. Valves very depressed convex. Surface of the shell marked by rather fine, regularly increasing, concentric ridges, which are elevated, and separated by sharply depressed spaces of nearly equal width. These are crossed by radiating ridges, which are strongest for a short distance from the anterior end and on the postero-cardinal slope, being sharp and coarse on the latter part, but broad and gently rounded on the anterior end; while on the middle of the valve they are much finer and very subdued, scarcely appearing except in the depressions between the concentric ridges, and barely observable without the aid of a glass.

This shell seems to have been Mr. Conrad's type of the genus *Linearia*, as far as the structure of the hinge is to be considered, the characters of which he appears to have obtained from the Haddonfield specimens; while the species was first described from examples of small size, from Snow Hill, N. C. The hinge-plate, as shown in the New Jersey shells, is rather wide, the cardinal teeth are seen to be two, narrow, oblique, and slightly diverging, directed anteriorly, the posterior of the two strongest and rather rounded on the back in the right valve, with a long, shallow but distinct pit distant from the beak on each side, representing the laterals of the left valve. The muscular impressions are large and shallow, while the pallial line is invisible on any of the specimens which I have examined; but Mr. Conrad says "the pallial sinus is rounded and extends to a direct line between the apex and ventral margin, according to D'Orbigney's fig. 5, and beyond that point in fig. 17," referring to some one of D'Orbigney's works which he does not cite. In the specimen, of which I have figured the interior, the pallial line is entirely covered with a paper pasted over the inside of the shell, to hold together the many fragments into which it has been broken, so that I dare not attempt its removal.

Formation and localities.—The larger cast figured is from Holmdel, New Jersey, in a collection made by the Rev. Dr. Riley. The shells are from Haddonfield, and Conrad's type of the species was from Snow Hill, North Carolina.

Linearia contracta, n. sp.

Plate XXIII, Fig. 5.

Shell small and moderately convex, transversely ovate in outline, broad in front and abruptly contracted behind the beaks, the anterior end forming about three-fifths of the shell's length. Beaks small and inconspicuous. Anterior end broadly rounded and the posterior more narrowly rounded. Basal line broadly curved. Surface of the shell as seen in a matrix, marked by fine radiating striæ which extend over the entire surface, but are less strongly developed on the middle of the valve. Also marked by fine concentric grooves parallel to the margin of the shell.

This species differs from *L. metastriata* in being proportionally longer, in the abrupt contraction of the posterior end, in its ovate instead of oval form, greater convexity, and in being marked by radiating striæ throughout instead of having the central part of the valve nearly or quite destitute of this marking.

Formation and locality.—In dark micaceous clay marls at the base of the Lower Marls, at Holmdel, New Jersey.

Genus ÆORA Conrad, 1871.

(Am. Jour. Conch., Vol. VI, p. 72, 1871.)

Æora cretacea.

Plate XXIII, Figs. 16 and 17.

Æora cretacea Conrad. Am. Jour. Conch., Vol. VI, p. 72, Pl. III, Fig. 8.

Shell small or below a medium size, longer than high, and subtriangular or triangularly elliptical in outline. Valves convex, with small subcentral beaks, which are nearly opposite the middle of the valves; cardinal margins sloping from the beaks at nearly an equal angle on the opposite sides, and forming with each other an angle of about one hundred and twenty degrees, the anterior side a little excavated in front of the beak. Anterior margin of the valve more sharply rounded than the posterior, and the basal line broadly curved. Surface of the shell marked by irregular concentric lines of growth only.

The general expression of this shell when viewed externally is *Mactra*-like, and, were it not for a knowledge of the hinge, might readily be supposed to belong to that genus; but internally the hinge differs very materially. Dr. Stoliczka, in copying Mr. Conrad's generic description, very properly corrects the V-shaped tooth of the left valve to an Λ-shape, and places the genus under the *Tellinidæ*, where it probably belongs, notwithstanding its *Mactra*-like appearance, as it does not possess an internal cartilage plate.

Formation and locality.—In the micaceous clays of the Lower Marls at Haddonfield, New Jersey. Borrowed from the collection of the Academy of Natural Sciences, Philadelphia.

Genus ÆNONA Conrad, 1871.

(Am. Jour. Conch., Vol. VI, p. 74.)

Ænona Eufaulensis.

Plate XXIII, Figs. 2 and 3.

Tellina Eufaulensis Conrad. J. A. N. Sci., Vol. IV, p. 277, Pl. XLVI, Fig. 15. Gabb, Synopsis, p. 173. Meek, Check-list, p. 14.
Ænona Eufaulensis Con. Am. Jour. Conch., Vol. VI, p. 74. Stoliczka, Pal. Indica, p. 482.

Shell small, triangularly ovate in outline, three-fourths as high as long, with the small beaks situated a little more than one-third of the length from the anterior end. Cardinal margins rapidly sloping from the beaks, the anterior most rapidly, and the anterior end sharply rounding just above the basal line; posterior end more broadly rounded, but still narrowed; basal line broadly curved. Surface of the valve smooth and semipolished, the disk rather highly convex for a *Tellina*-like shell, with very small pointed beaks, a slight angularity of the umbonal region just in front of it, and a very narrow but distinctly circumscribed lunule. In the interior the hinge-plate is very narrow, with a single small cardinal tooth in the right valve and very small and narrow lateral teeth. Muscular markings unknown.

This species differs from *Ænona papyria* Conrad, principally in the even, smooth, or semi-polished surface, that one being without polish and marked with uneven concentric lines of comparatively great strength; also in the want of the flattening of the shell on the shorter end, and in the greater thickness and firmer substance of the shell. The shell occurs in the collection of the Academy of Natural Sciences, Philadelphia, labeled, in Conrad's writing, *Temesa Eufalensis*, but corresponds to the figure of *Tellina Eufalensis* given in the Journal of the Academy of Natural Sciences, as above cited, except that it is a right instead of a left valve, and is slightly imperfect at the anterior end. The shell cannot be mistaken for a species of *Tenera*, and I find no reference to the genus *Temesa*. There can be no question, however, in regard to the identity of this specimen with that described as *Ænona Eufaulensis*.

Formation and locality.—In the micaceous clays below the Lower Green Marls at Haddonfield, New Jersey. Mr. Conrad's type of the species *Tellina Eufaulensis* (afterward changed to *Ænona Eufaulensis*) was from Eufaula, Alabama. There are casts of small shells of a character similar in form to this among collections from Mr. Schanck's pits near Marlborough, but it is difficult to identify positively such imperfect material.

Ænona papyria.

Plate XXIII, Fig. 4.

Ænona papyria Conrad. Am. Jour. Conch., Vol. VI, p. 74.

Mr. Conrad's description of this species is as follows: "Subelliptical, inequilateral, extremely thin in substance, convex, anterior side narrowed; posterior end obliquely truncated; ventral margin regularly curved; surface marked by microscopic concentric lines. Length, ⅝ inch."

A single right valve, marked with the name *Tellimera papyria* Conrad, exists in the collection of the Academy of Natural Sciences, Philadelphia, which agrees closely with the above description. As I can find no description or reference to such a species under that generic name, I am led to suppose this shell was at first considered as a *Tellimera*, but subsequently placed and described under *Ænona* without changing the label. The specimen has now lost all the beak and cardinal parts, and I can only give a restored figure of the outside of the valve. It is very much elongated transversely, and of an elliptical form, as well as extremely thin in substance.

The surface markings are very fine, and represent lines of growth only. It is probable that some of the many small indistinct casts from the micaceous clays beneath the Lower Green Marls at the Rev. G. C. Schanck's pits, near Marlborough, N. J., may belong to this species; but so far I have not seen anything so transversely elongated.

Formation and locality.—The specimen above described is from Haddonfield, New Jersey, from the micaceous clays at that place.

Genus CORIMYA Agassiz.

Corimya tenuis, n. sp.

Plate XXIII, Figs. 9–11.

Shell small in size, the largest individual cast observed measuring scarcely one and a quarter inches in length. Form triangularly-elliptical, with nearly central beaks, from which the cardinal margins slope rapidly on each side, the extremities being nearly equally rounded, but the posterior narrower than the anterior, and the postero-cardinal margin very slightly contracted near the beaks. The valves have been depressed convex, unequal and slightly twisted, the right valve less convex than the left, and its basal margin concave as viewed on the basal edge. Surface of the cast marked by concentric undulations, indicating a somewhat distinctly undulated shell surface. Muscular scars as indicated on the casts rather large, the posterior one bounded on its inner side by a depressed groove indicating a ridge on the inside of the shell; much the strongest on the right valve. No evidence of a pallial sinus has been seen on any of the specimens. The surface of the disk of the cast, on those which indicate a thickening of the shell, is marked by radiating vascular lines, most distinct on the posterior side of the beaks, and evidences of a few radii on the anterior third.

The internal casts of this species are not uncommon at several localities of the Lower Marls, and are extremely *Tellina*-like in their characters and appearance. They occur of all sizes, from half an inch in length to that of the largest one above mentioned, and are usually thin, flattened specimens, often with but little character by which they can be recognized. The more ventricose and larger individuals closely resemble casts of *Peri-*

plomya elliptica, which I think ought also to be placed under the genus *Corimya*, but they are never so ventricose and never so much constricted behind the beaks as are casts of that species, so that their triangularly-elliptical outline will always readily distinguish them. They also bear considerable resemblance to casts of *Linearia metastriata* Conrad, from which it will be difficult to distinguish them if ever found associated. The slope of the cardinal margin and the impressed groove bordering the muscular impression, as well as the inequality and twisting of the valves, will be a guide in determining their relations. There can be no question, I think, about the generic reference of the species, as they correspond in every particular with both description and figures of the species referred by Prof. Agassiz to his genus *Corimya*.

Formation and locality.—In the Lower Marl Beds, Upper Freehold, collected by Dr. Bruere, and at Marshallville, Salem County, New Jersey. I have also seen quite a number of these casts in the collection of the Academy of Natural Sciences, Philadelphia, from several localities.

DONACINIDÆ.

Genus DONAX Linn.

Donax Fordii.

Plate XXIII, Fig. 1.

***Donax Fordii* Conrad. Am. Jour. Conch., Vol. V, p. 102, Pl. IX, Fig. 27.**

Shell below a medium size for the genus, triangularly cuneate, very inequilateral, the anterior end being nearly twice as long as the opposite. Valves ventricose, the extremities sharply rounded, the anterior broadest at the end. Surface of the shell polished and marked by fine radiating impressed lines, which strongly and deeply crenulate the margin of the shell.

This shell is so exactly a representative of the living species common along the Atlantic coast that it would be extremely hazardous to its specific distinction to institute comparisons. The specimen is very imperfect in form, having had the beaks crushed in and the shell partially exfoliated; but the characters are sufficiently preserved to establish at once its relations.

The figure given by Mr. Conrad, cited above, is much too equilateral, and does not represent the specimen in hand, which is the only one known, and that from which his figure was made.

Formation and locality.—In the micaceous clays below the Lower Marl, at Haddonfield, New Jersey. From the collections of the Academy of Natural Sciences, Philadelphia.

MACTRIDÆ.

Genus VELEDA Conrad, 1871.

(Am. Jour. Conch., Vol. VI, p. 74.)

Veleda lintea.

Plate XXIII, Figs. 18–21.

Cardium (*Protocardium*) *linteum* Conrad. J. A. N. Sci., Phil., new ser., Vol. IV, p. 278, Pl. XLVI, Fig. 17.
C. *linteum* (Con.) Gabb. Synopsis, p. 107.
Veleda lintea Conrad. Am. Jour. Conch., Vol. VI, p. 74. Geol. Surv. N. Car. (Kerr's), p. 9, of Appendix, Pl. I, Fig. 26.
Cymbophora lintea (Con.) Gabb. P. A. N. Sci., 1876, p. 306.

Shell small, subtriangular in outline or somewhat transversely elongate-triangular. Valves (left ones only seen) moderately ventricose, most prominently so on the umbones and anterior to the middle; beaks proportionally large, situated a little posterior to the middle of the length; anterior end of the valves largest, rounded on the margin; basal line having a broad regular curve, and the posterior end obliquely sloping from the apex of the valve, and a little more squarely truncate just above the basal angle. Umbonal ridge angular, but not carinate, rather decidedly marked, and the posterior slope somewhat abrupt. Surface of the left valve marked by very fine, but regularly increasing, even concentric ridges, which are separated by very narrow deep lines. Along the posterior umbonal angle there is one or possibly two faint radiating lines, one forming the crest, the other posterior to it, but faint.

The form and general appearance of these shells, in the only two imperfect examples which I have seen, is much like the smaller valve of a *Corbula*, and would be commonly considered as such unless the hinge were observed. Mr. Conrad at first supposed it to be a *Protocardium*, but subsequently made it the type of his new genus, *Veleda*. The hinge features on the specimens which I have before me are very imperfect, although I am inclined to think they furnished the material for his generic diagnosis. He describes them as follows: "Equivalved. Hinge character; left valve with a V-shaped cardinal tooth under the apex, and three compressed teeth, posterior one elongated and parallel with the dorsal margin, cardinal plate channeled, deeply so anteriorly." I have drawn the features of the hinge as near as practicable, enlarged, from the best individual of the two, just as it was prepared by Mr. Conrad, and shall offer no comments as to the value of his genus. Among some imperfect casts which I have referred to the same genus there is one which shows the cardinal margin to have been strongly grooved in front and behind, and on one, which is of a right valve, the posterior side shows two ridges, representing a double groove on that side, the outer one the smallest of the two.

Mr. Gabb (*loc. cite.*) says there is no difference between this species and the typical form of his genus *Cymbophora*, described in the Paleontology of California, except that of size and the peculiar cross-striations of the lateral teeth, the latter feature not having been observed in the California specimens. As there would appear to have been some doubt in his own mind as to their absolute identity, and as his observations were made on specimens identified from Georgia, I think it best to leave it as Mr. Conrad placed it until more positive information is obtained.

Formation and locality.—Mr. Conrad's original type of the species was from Tippah County, Miss., Dr. Toumey's collection, while his generic types are marked Haddonfield, New Jersey. The internal casts mentioned under the remarks above are from the micaceous clays beneath the Lower Marls, at the Rev. G. C. Schank's pits near Marlborough; New Jersey State cabinet.

Veleda Tellinoides, n. sp.

Plate XXIII, Fig. 23.

Shell large for the genus, the cast, the only form under which it is known, being fully one and a quarter inches in length; form transversely ovate, largest at the anterior end, and two-thirds as high as long. Valves depressed convex with small appressed beaks and a slight angulation passing from the beak to the posterior extremity, forming a narrow posterior cardinal slope. Surface, as shown on the cast, marked by fine concentric lines of growth. Muscular scars proportionally large and moderately distinct, and an indication of a rather deep sinus in the pallial line.

This species differs from *V. lintea* in the more transverse form, less angular umbonal ridge, which is also situated nearer to the cardinal border; in the less elevated form and more arcuate basal margin, and also conspicuously in want of the coarse, regular, concentric markings of the surface seen on that one. In regard to its generic affinities there may be a little doubt, as the hinge has been much less thickened and consequently the impressions of the teeth are less conspicuous and consequently less certain.

Formation and locality.—In the dark micaceous clays below the Lower Marls at the Rev. G. C. Schank's pits near Marlborough, Monmouth County, New Jersey. From Professor Lockwood's collection.

Veleda transversa, n. sp.

Plate XXXIII, Fig. 22.

Shell transversely elliptical, about three-fifths as high as long and very depressed convex; beak, as seen on internal casts, rather prominent and pointed, situated at or a little behind the anterior third of the entire length of the shell; umbonal angle very distinct but not elevated; basal and cardinal margins nearly equally arcuate, the anterior end broadly rounded and the posterior obliquely truncate, being longest at the point where the umbonal ridge cuts the margin. Surface of the shell marked by regular, even, concentric ridges, about five of which occupy an eighth of an inch in width near the basal margin of the specimens figured. Hinge-line unknown, except the short lateral teeth on each side of the beak shown by the linear depressions on the cast.

This species is nearly of the form of *V. tellinoides*, but is less pointed behind, has a more prominent and more angular umbonal ridge, and the beak is somewhat more distant from the anterior end, and the surface more coarsely striate.

Formation and locality.—In the dark micaceous clays below the Lower Marls at Marlborough, New Jersey, in Mr. Lockwood's collections from that place.

ANATINIDÆ.

Genus PHOLADOMYA, Sowerby.

Pholadomya occidentalis.

Plate XXIV, Figs. 1–3.

Pholadomya occidentalis Morton. Synopsis, p. 68, Pl. VIII, Fig. 3. Gabb, Synop. Cret. Form., Meek, Smithson. Inst. Check-list, etc.

Shell of rather more than medium size, ovate in outline and very ventricose, and as far as can be safely determined from all the specimens which I have seen the valves closely meet at both extremities. Beaks large and broad, incurved so as to be nearly in contact, but not prominent, resting only moderately above the hinge-line, and situated well forward. Hinge-line straight, nearly two-thirds as long as the shell and bounded by a rather distinct and broadly excavated cardinal area, the limit of which near the beaks on each side of them is distinctly angular. Anterior end of the shell obliquely truncated; posterior end more narrowly rounded, and the basal margin strongly curved, being a little gibbous in its curvature near the middle of its length.

Surface of the specimens, the shell never being preserved, is marked by strong radiating ribs, which are most numerous and most closely arranged near the middle of the valves and gradually become more distant toward each extremity, those on the extreme anterior end and those near the postero-cardinal border being nearly or quite twice as far apart as those on the middle of the valve. On many individuals every other ray along the central section of the valve, and sometimes extending well toward the posterior, is seen to die out before reaching the beak. By this arrangement the disk of the shell has been divided indistinctly into three sections, marked by the simple spaces between the rays on each end, and by having intercalated rays between on the central space. On the most perfect individual used, figured on the plate, which is about three and a half inches in length, there are about thirty ribs determinable, and on the smaller one figured only about twenty-seven can be counted. The casts also show strong concentric lines of growth, which in crossing the rays gives them a strongly wrinkled or nodose and sometimes a distorted and flexuose character.

It is even more than probable that the shells of this species, when perfect, have been gaping at the posterior, if not at each end; but all those which I have seen have been more or less compressed and imperfect, so that their closed character cannot be said to be certainly determined. As they appear to possess all the features of the typical forms of the genus in other respects, it would be safe to assume they have been somewhat gaping, at least posteriorly. On the large specimen figured, which is the property of the Am. Mus. of Nat. History, New York, the anterior muscular imprint is seen to be of large size near the anterior end, but only faintly marked.

Formation and localities.—The species is found at Monmouth, Burlington, and other localities in the Lower Green Marls of New Jersey, and is credited by Mr. Gabb to Delaware and to Mississippi. The original figure given by Morton, *loc. cit.*, is very erroneous in all its details, having but little resemblance to any specimen which I have ever seen.

Pholadomya Roemeri n. sp.

Plate XXIV, Fig. 4.

Shell rather small for the genus, being only about two inches long. Valves very convex, with moderately tumid beaks, which are nearly terminal; form obliquely ovate in outline, somewhat wider behind the middle than in front, exclusive of the beaks. Hinge-line rather long. Surface of the shell marked by thirteen radiating ribs, which are sharp and elevated, and are separated by broad concave interspaces. Those on the anterior end of the shell are distant and curved forward, while those on the body of the shell gradually decrease in distance as they progress backward. There are also very distinct and proportionally distant concentric striæ marking the shell, forming slight nodes on the radii where crossing them.

This species, so far as seen, is smaller than *P. occidentalis* Morton, and is less regularly oval in outline, being more elongate. The radii are much less numerous, in fact are less than half as numerous as is usual on that species. It approaches much more nearly in form and character to *P. pedernalis* Römer, from Texas, but does not possess the prominent beaks of that species, and has rather more radii, that one having only six or seven.

Formation and locality.—In the micaceous clays below the Lower Marl Bed, at the Rev. G. C. Schank's pits, near Marlborough, Monmouth County, New Jersey.

Genus PERIPLOMYA Conrad.

Am. Jour. Conch., Vol. VI, p. 76 = *Leptomya* Con., Am. Jour. Conch., Vol. III, p. 15.

Periplomya elliptica.

Plate XXIII, Figs. 14 and 15.

Anatina elliptica Gabb. P. A. N. S., Phil., 1861, p. 324. Meek, Check-list, p. 15. Geol. Surv. N. J., 1868, p. 727.
Periplomya elliptica Gabb. P. A. N. S., Phil., 1876, p. 305.

Shell small, inequivalve, and very inequilateral, subovate in outline, largest across the anterior side of the beaks, and strongly constricted just behind them, the posterior end being narrowed on the hinge-line and excavated at this point. Valves somewhat ventricose, the right one less convex than the left, and very decidedly depressed in the central region and toward the basal line, showing a decided twist or arcuation of the valves as seen in a basal view. Anterior end broadly rounded, and the posterior pointedly rounded. Beaks small, appressed, incurved, and apparently directed backward, as is usual in this group of shells, from the expansion or inflation of the anterior side of the hinge-line. Cardinal margin, as seen on the cast, inflected both in front and behind the beaks, forming an apparent lunule and escutcheon on the cast, probably produced mainly from a thickening of the hinge-plate within. Muscular imprints and pallial line and hinge not observed.

This appears to be a rare form of shell in the Cretaceous strata of America, only a very few individuals having been observed by any one. I have seen only two individuals besides Mr. Gabb's type, but the latter author speaks of Mr. Conrad having seen three specimens. The generic relations of the species are somewhat obscure, as none but internal casts have been found, which do not retain the features of the hinge. Mr. Conrad appears to have identified it positively with his genus *Periplomya* for Mr. Gabb, but I can see no valid reason why it should not be placed under Agassiz's genus *Corimya*, 1843, a genus which occurs in Europe in the Cretaceous and Jurassic. There certainly seems to be no difference in the form of the casts, unless it be in the absence of the internal rib, which is described as occurring in the right valve of some specimens of that genus, bordering the muscular impression. Prof. Agassiz refers *Corimya* to the *Isocardes*, but its affinities are certainly with *Anatina*, as they have been placed by later authors.

Formation and locality.—In the Lower Green Marls at Mullica Hill and Holmdel, New Jersey.

Genus CERCOMYA Agassiz.

Cercomya peculiaris.

Plate XXIII, Figs. 24 and 25.

Inoceramus peculiaris Conrad. Am. Jour. Conch., Vol. V, p. 43, Pl. I, Fig. 13.
Cercomya peculiaris Conrad. Am. Jour. Conch., Vol. VI, p. 76.

A single fragment of a cast of one valve only has been seen of this species, and that altogether too imperfect to afford means for positive generic reference. The form somewhat resembles species of *Cercomya* Agassiz, but is by no means unquestionable, and is fully as much like *Thracia*. The form has been subtriangular, with an obliquely truncated anterior end, slightly gaping; the posterior part of the shell more elongated, slightly curved, and more widely gaping. Valves moderately convex and strongly furrowed concentrically. On the left valve there is evidence of a proportionally wide hinge-plate, with a large deep ligamental cavity beneath the apex. No evidences of teeth or teeth-like projections are preserved, as only the impression of the under surface of the plate is shown.

Formation and locality.—In the lower portion of the Lower Green Marls at Crosswicks, New Jersey.

CORBULIDÆ.

Genus CORBULA Bruguière.

Corbula crassiplica.

Plate XXIII, Fig. 30.

Corbula crassiplica Gabb. J. A. N. Sci., new ser., Vol. IV, p. 394, Pl. LXVIII, Fig. 25. Synopsis, p. 110. Meek, Check-list, p. 15. Geol. Surv. N. J., 1868, p. 727.
Corbula perbrevis Conrad. Kerr's Geol. Rept. N. Car., Appendix, p. 17, Pl. II, Fig. 5.

The shells upon which this species is identified from New Jersey are very small, scarcely exceeding a fourth of an inch in length, the height being about the same. Very ventricose on the right valve and of a subtriangular form. Beak large, inflated and enrolled, nearest the anterior end. Anterior umbonal ridge subangular, and marked by a narrow groove, which divides the concentric ridges at this point. Posterior end short, with a very marked fold separating the postero-cardinal slope from the body of the valve. Body of the valve marked by coarse, strong, and rounded concentric folds, varying in number according to the size of the shell. Left valve less ventricose than the right, and destitute of the strong folds, or marked only by irregular concentric lines.

The species bears considerable resemblance to *C. Murchisoni* Lea, from the Eocene sands of Claiborne, Alabama. In fact it is quite difficult to point out characters by which they can be distinguished as seen on the imperfect specimens which I have examined from New Jersey. These are scarcely half the length of the one figured by Mr. Gabb in the Journal of the Academy of Natural Sciences, unless that figure be an enlargement. I have not seen a left valve in a condition for illustration, and none of the examples show the interior in a condition to be described, as they are extremely fragile and will not bear handling. The small specimen figured by Mr. Conrad as *C. perbrevis* from North Carolina *loc. cit.* is so exactly like the New Jersey forms both in size and general appearance, that the figure would answer perfectly for an illustration of one of these. In Mr. Conrad's remark on the generic relations of this group of Cretaceous *Corbulæ* he appears to consider them as pertaining to the genus *Pachydon* Gabb on account of their spiral beaks; and in the same connection one obtains an explanation of Mr. Conrad's reasons for the formation of so many genera by that author, in his intimation of a belief "that all life was destroyed at the close of the Cretaceous era;" a belief not warranted by facts, and one intended to lead a paleontologist into any amount of excess in the formation of genera and species.

Formation and locality.—In the dark micaceous clays below the Lower Marls at Haddonfield, New Jersey. From the collection of the Academy of Natural Sciences of Philadelphia.

Corbula Foulkei.

Plate XXIII, Figs. 27-29.

Corbula Foulkei Lea. Proc. A. N. Sci. Phil., 1861, p. 149. Pamph., p. 41. Meek, Check-list, p. 15. Geol. Surv. N. J., 1868, p. 727.

Shell of small size, elliptically triangular in outline, posterior end shortest and acutely pointed; anterior end rounded, the left valve more extreme in form than the right, which is more ventricose and higher than the left. Beaks tumid and incurved, that of the larger valve most distinctly so. Surface marked by moderately strong concentric striæ and very strong varices of growth. Substance of the shell thick; teeth only moderate in size; muscular markings distinct.

As I have not been able to find the original specimens described by Mr. Lea, I can only infer from his description that I have rightly identified the form, as he does not figure it The form here described varies some from the somewhat general characters given, but it is the most common form found at Haddonfield, and as both the others recognized at that locality have been figured by their author, I think there can be but little doubt of the accuracy of the reference here made.

Formation and locality.—In the soft micaceous clays below the Lower Marls at Haddonfield, New Jersey. Collection of the Academy of Natural Sciences of Philadelphia.

Corbula subcompressa.

Plate XXIII, Fig. 26.

Corbula subcompressa Gabb. J. A. N. Sci. Phil., new ser., Vol. IV, p. 394, Pl. LXVIII, Fig. 24. Synopsis, p. 111. Meek, Geol. Surv. N. J., 1868, p. 727.

Shell small, transversely triangular, and nearly equilateral. Left valve moderately convex, most inflated along the umbonal ridge and on the anterior third; beak small, incurved, appressed; posterior slope moderate and the ridge angular. Surface marked by fine concentric lines. Shell thin. Interior not observed.

Only a single imperfect left valve has fallen under my observation, and it so mutilated that the hinge features cannot be obtained.

Formation and locality.—In the soft micaceous clays below the Lower Marls at Haddonfield, New Jersey. Collection of the Academy of Natural Sciences of Philadelphia.

SAXICAVIDÆ.

Genus PANOPEA Ménard.

Panopea decisa.

Plate XXIV, Figs. 5–8.

Panopea decisa Conrad. J. A. N. Sci., Phil., Vol. II, 2d ser., p. 215, Pl. XXIV, Fig. 19. Meek, Check-list Smith. Inst., p. 15.

Glycimeris decisa (Con.) Gabb. Synop., p. 125. Meek, Geol. Rept. N. Jersey, 1868, p. 727.

Shell moderately large and ventricose, with moderately large projecting beaks, which are situated a little nearest the anterior end, widely gaping at the posterior end and closed anteriorly. Anterior extremity rounded, longest below the middle, anterior end truncated, projecting near the cardinal line and receding below. Surface of the shell marked by very strong, broad, concentric undulations most strongly developed on the middle of the valves and becoming nearly obsolete on some specimens both anteriorly and posteriorly. The valves are also often depressed along the posterior umbonal slope, showing a distinct furrow at the bending of the undulations of the surface at this point.

The internal features of the species are not easily made out from the imperfect casts under examination, the shell having been too fragile to leave the impressions of pallial line or muscular scars so as to be traced with any degree of certainty. The hinge, however, has been considerably thickened and has left the imprint of its features on some of the specimens, so that by the use of gutta-percha its features have been fairly shown. There is positive evidence of only a single projecting tooth in each valve, which has been long and incurved, but showing that the shell was not indented or excavated for their reception, as should be the case in *Glycimeris*, to which genus Messrs. Gabb and Meek have referred it. In the right valve, however, the hinge-fold recedes on the anterior side of the tooth, but not in the form of a notch for the reception of the tooth, as it leaves the tooth entirely free and uncovered, while in the left valve the hinge-fold is entirely straight on the face. The folds or plates for the reception of the ligament have been quite large and distinct. Considering the above features I have concluded to place the species back under *Panopea*, where Mr. Conrad originally placed it, as the evidence seems to be more in favor of that reference than to *Glycimeris*. Dr. Stoliczka also considers it as not belonging to the genus *Glycimeris*, judging only from Mr. Conrad's figure.

Formation and locality.—In the Lower Green Marls at Holland, Monmouth County, and near Burlington and elsewhere in New Jersey.

SOLENIDÆ.

Genus SOLYMA Conrad. 1871.

(Am. Jour. Conch., Vol. VI, p. 75.)

Solyma lineolata.

Plate XXV, Figs. 11–13.

Solyma lineolatus Conrad. Am. Jour. Conch., Vol. VI, p. 75, Pl. III, Fig. 9. Gabb, Proc. A. N. Sci., 1876, p. 305.

Shell transversely elongate-elliptical, about twice as long as high, with subparallel dorsal and basal margins, the anterior end rounded and the posterior end subtruncate, a little longer above than below. Valves convex, with a very slight angulation along each umbonal slope; beaks large, prominent, nearly centrally situated and projecting somewhat strongly above the cardinal line. Surface of the shell marked only by fine concentric lines of growth. Hinge-plate very narrow and teeth short. Muscular scars, the anterior only seen, small, obscure, and somewhat elongate.

The shell resembles in its general expression a species of *Solecurtus*, with which genus Dr. Stoliczka feels inclined to associate it. There is but a single imperfect right valve in the collection, and this appears to be the only one Mr. Conrad used in formulating his genus. The pallial line is not visible nor is the posterior muscular impression, and the hinge characters are all that are given as generic characters. I know of no other New Jersey Cretaceous shell with which it can be confounded.

Formation and locality.—In the micaceous clays of the Lower Marls at Haddonfield, New Jersey. Borrowed from the collection of the Academy of Natural Sciences of Philadelphia.

Genus LEPTOSOLEN Conrad.

(Am. Jour. Conch., vol. iii, p. 15 and p. 188.)

Leptosolen biplicata.

Plate XXV, Figs. 1 and 2.

Siliquaria biplicata Conrad. J. A. N. S., Phil., 2d ser., Vol. III, p. 324, Pl. XXXIV, Fig. 17. Gabb, Synop., p. 170. Meek, Smith. Inst., Check-list, p. 15.
Leptosolen biplicata Conrad. Am. Jour. Conch., Vol. III, pp. 15, 188. Meek, Geol. Rept. N. Jersey, 1868, p. 727. Gabb, P. A. N. S., 1861, p. 304.

Shell of medium size, two and a half to three times as long as wide, with parallel dorsal and basal margins. Valves quite convex when not compressed, and gaping at each extremity; beaks small and inconspicuous, situated within the anterior third of the length; posterior extremity truncate, a little the longest below the center; anterior end more distinctly rounded, longest above the middle. Surface of the shell marked by concentric lines of growth, which are wiry and distinct upon the impressions in the marls, but indistinct on the internal casts. On the anterior part of the shell there are two indistinct plica extending from in front of the beaks, one to the anterior basal angle and the other to the margin of the valve about midway between the first and the antero-dorsal angle. On the casts there is a strong groove extending obliquely across the valve from the beaks to near the base, gradually widening from its origin and passing gently backward in its extension, marking the position of an internal rib on the shell. The hinge features cannot be determined from either of the two imperfect specimens before me. The larger of the specimens would indicate a shell of nearly two inches in length with a width of almost five-eighths of an inch.

This species is the type of the genus *Leptosolen*, the principal generic feature resting upon the single direct tooth of the right valve, a feature which cannot be seen on the internal casts found in this State; and as Conrad has not figured this feature so far as I can ascertain, I am not able to judge of the validity of the characters.

Formation and locality.—The casts which I have described are from the micaceous clays under the Lower Marl Bed, at the pits of the Rev. G. C. Schanck, near Marlborough, N. J., in Mr. Lockwood's collection. There are also two fragments of shell which are apparently of this species from the white limestone nodules at the base of the Lower Marl Bed at Marlborough, in Mr. Schanck's collection. These latter specimens show a strong posterior umbonal ridge and a thickness of shell which one would scarcely deem compatible with the characters and tenuity of the shell indicated on the casts, and may possibly belong to a distinct form.

Genus LEGUMEN Conrad, 1858.

(Jour. A. N. Sci., Phil., Vol. IV, p. 277.)

Legumen planulatum.

Plate XXV, Figs. 3 and 4.

Solemya planulata Con. J. A. N. S., Phil., 2d ser., Vol. II, p. 274, Pl. XXIV, Fig. 11. Gabb, 1859, Cat. Invert. Foss., p. 16.
Legumen planulata (Con.) Gabb. Synop., p. 133.
L. planata (Gabb.) Meek. Check-list Smith. Inst., p. 15.
L. elliptica and *L. appressa* (Con.) Gabb. P. A. N. Sci., 1876, p. 304.
Comp. *L. appressus* Conrad. J. A. N. S., Phil., 2d ser., Vol. III, p. 325.

Shell of small size, transversely elongate, about twice and a half as long as high, and elongate-elliptical in outline with the extremities rather sharply rounded. Valves very compressed or flattened, especially so on the posterior part. Beaks small, appressed, not projecting, situated within the anterior third of the length. Surface of the shell marked by proportionally strong regular concentric striæ. The internal cast shows a well marked gash behind the anterior muscular imprint, the result of an internal rib similar to that existing in *Machæra*.

In Mr. Meek's list of New Jersey fossils, given in the report for 1868, p. 727, he cites two species of this genus as occurring in the State, but does not mention this one. Mr. Conrad's type of this species was from Monmouth County, New Jersey, and is the only one originally described from this State. Among the fossils from the State which I have examined I have found none corresponding to the figure given by Mr. Conrad of *L. ellipticum*, but to *L. appressum*, which is not figured, it seems to be very nearly related, but is less contracted in front, giving a wider anterior end, which makes it appear proportionally longer. As compared with shells of *L. ellipticum*, from Tippah County, Mississippi, this one has been more slender in proportion to its length, with extremities less broadly rounded, and the shell not so high posteriorly. Mr. Gabb considers all these forms as only stages of growth of *L. planulatum*, to which I do not agree.

Formation and locality.—In the Lower Green Marls at Freehold, and from the marl pits of G. C. Schanck, Monmouth County, New Jersey.

Legumen appressum.

Plate XXV, Figs. 6–8.

Legumen appressa Conrad. J. A. N. Sci., new ser., Vol. III, p. 325. Gabb, Synopsis, p. 133. Meek, Check-list, p. 15. Geol. Surv. N. J., 1868, p. 727.

See *Legumen appressa* Conrad. Kerr's Geol. Rept. N. C., appendix, p. 16, citing J. A. N. Sci., Vol. III, p. 325, Pl. XXXIV, Fig. 19, as this species; also the same figure given as *L. ellipticus*, J. A. N. S., *loc. cit.*

Shell transversely elliptical, about twice and a half as long as high, with depressed convex valves and small, appressed beaks, which are situated just within the anterior third of the length of the valves. Thickness of the shell through the valves, in an uncompressed specimen, equal to two-fifths of the height from the dorsal to the ventral margin. Anterior end of the shell narrowed in front of the beaks and narrowly rounded at the extremity; posterior end also sharply rounded, the longest part being above the middle of the height; dorsal and ventral margins parallel, but each moderately curved. Ligament proportionally long, imbedded in a narrow, deep escutcheonal area; lunular depression very slight. Surface of the shell marked by fine, regular, even, step-like concentric ridges, strongest on the posterior part of the shell.

It is somewhat difficult to point out distinctions between the species of this genus where they are preserved as internal casts only, the markings of the surface being only partially or not at all preserved, and the form of the shell scarcely indicated in the parts where most distinct when the shell itself is examined. So far as I can distinguish, the casts which I have figured belong to the *L. planulatum*, and appear to differ from the shell here used in the form of the posterior end, and in the narrowing of the anterior portion in front of the beaks. The specimen here used is in the collection of the Academy of Natural Sciences, marked *L. appressus* in Mr. Conrad's handwriting, and is accompanied by another, without mark, which agrees nearly enough with his figure of *L. ellipticum* (J. A. N. S., Vol. III, Pl. XXXIV, Fig. 19) to have been the one used in making that figure. The two differ not only in the proportional length and height, but in the form of the anterior ends and in the character of the surface markings, the latter one not having the regular ridges, but irregular and fasciculate lines. By reference to the citations at the head of this description it will be seen that Mr. Conrad has at different times referred to Fig. 19 of Pl. XXXIV, J. A. N. Sci., Vol. III, both as *L. appressus* and *L. ellipticus.* The latter name being first applied to it, I suppose to have been correct, and the reference later made to have been an error. Mr. Gabb, in the Proc. A. N. Sci., 1876, p. 304, cites all these species under *L. planulata,* and considers them identical, considering the variations as different stages of growth only. It would be difficult to account for the contraction of the anterior end in front of the beaks on this hypothesis

Formation and locality.—In the dark micaceous clay below the Lower Marls at Haddonfield, New Jersey. Collection of the Academy of Natural Sciences, Philadelphia.

Genus SILIQUA Muhlfeld.

Siliqua Cretacea.

Plate XXV, Figs. 9 and 10.

Cultellus cretacea Gabb. Jour. A. N. Sci., Phil., new ser., Vol. IV, p. 303, Pl. XLVIII, Fig. 25 in text (24 on plate).
Siliqua cretacea Gabb. Synopsis, p. 170. Meek, Check-list, p. 15. Stoliczka, Pal. Indica, Vol. III, p. 100.
Ospriasolen cretacea (Gabb) Meek. Geol. Surv. N. J., 1868, p. 727.

Shell of moderate size, the internal cast, and the only one known, being nearly one and three-fourth inches long, and for the genus very convex, rather strongly curved, and widely gaping at each extremity, the valves only coming in contact in the middle of the basal margin; posterior end most widely gaping. Beaks distinct, but not elevated, situated a little within the anterior third of the shell's length. On the cast they slightly project above the general line of the hinge. Hinge slightly concave posterior to the beaks, and the margin considerably thickened, as indicated by the form of the cast. Anterior to the beaks the cardinal line declines at a low angle from the direction of the posterior side. Basal line very strongly curved; extremities rounded, the anterior the most sharply so. Anterior muscular scar moderately large, triangularly ovate, bordered by a rounded furrow on the posterior side, indicating a slightly thickened rib on the interior of the shell. Posterior scar larger, triangular, and faintly marked. Pallial sinus deep and extending to near the middle of the shell's length. Hinge features unknown. Indications exist on the cast of a divided tooth-like projection on the left valve, with a socket-like plate on the right.

The species appears to be a very rare one in the Cretaceous beds of New Jersey, only one individual cast having been seen so far as I can learn. Mr. Gabb originally described it as a species of *Cultellus*, but soon after referred it to the genus *Siliqua*, under which most authors agree in classing it. Mr. Meek, in his list of New Jersey fossils, first referred it to the genus *Ospriasolen*, a reference to or a description of which I have not been able to find in any other work, and do not know what characters it includes, or if he intended it for this individual shell.

Formation and locality.—In the Lower Green Marls (?) in Burlington County, New Jersey. Collection of the Academy of Natural Sciences, Philadelphia.

PHOLADIDÆ.

Genus PHOLAS Linn.

Pholas cithara.

Plate XXV, Figs. 14–16.

Pholas cithara Morton. Synopsis, p. 68, Pl. IX, Fig. 10. Gabb, Synopsis, p. 166. Meek, Check-list, p. 16. Geol. Surv. N. J., 1868, p. 728.
P. pectorosa Conrad. J. A. N. Sci., new ser., Vol. II, p. 299, Pl. XXVII, Fig. 9.
Clavipholas cithara (Morton) Meek. Geol. Surv. N. J., 1868, p. 728.
Martesia cithara (Mort.) Gabb. P. A. N. Sci., Phil., 1876, p. 304.

Shell triangularly ovate, acutely pointed behind and subtruncate in front. Valves very ventricose, the depth and thickness when united about equal, giving a nearly round section. Anterior umbonal ridge inflated and nearly subangular in some cases, always sharply rounded, and the anterior surface somewhat flattened or but little convex. Central region of the valves sulcated obliquely, more or less constricting the front margin at about or just behind the center. Hinge-line straight, deeply sunken between the large, inflated, and enrolled approximate beaks. Surface of the shell marked by strong radiating ribs, numerous but somewhat irregular posterior to the umbonal angle, but few and distant in front; also by comparatively strong concentric ridges, which are distinctly deflected at the mesial sulcus and pass obliquely upward in front of it. These concentric ridges form flattened nodes of the radiating ribs by crossing them on the anterior part of the shell.

I have seen several casts of this species, and notice considerable variation in their characters, especially in the strength of the surface markings, in the form of the anterior end, and in the strength of the mesial sulcus of the valves, and especially in the strength and character of a sometimes deeply impressed but narrow line marking the bottom of the sulcus and dividing the anterior and posterior sections of the shell, it being in some instances almost obsolete. Mr. Morton's type specimen, which I have not seen, seems to have been very small, and to have had the anterior end rounded from below, while Mr. Conrad's type of *P. pectorosa* is full and round below and sloping above, while a cast of a single valve which is figured; appears to have been quite sharply truncate in front and angular on the umbonal ridge. There is also much difference in the proportional strength of the two sets of ribs in the different examples.

Formation and locality.—In the Lower Green Marls at Mr. G. C. Schanck's marl pits near Marlborough, New Jersey. Mr. Conrad's example, which is the largest and most perfect individual observed, was collected at Tinton Falls, Monmouth County, by Prof. L. Vanuxem. A single specimen of medium size in the collection of the Academy of Natural Sciences at Philadelphia, placed with the type of *P. pectorosa* under the same label, appears, from its lithological character, to have come from the yellow limestone of the Middle Marl Beds, but may be deceptive in this respect.

Pholas ? lata, n. sp.

Plate XXV, Fig. 17.

Shell large and proportionally very broad between the dorsal and basal margins, the relative height and length being about as two to three, respectively. The general outline is slightly ovate, widest at the anterior end and gradually narrowing posteriorly, the beak being a little in advance of the middle and showing somewhat above the cardinal line in the slightly compressed and somewhat crushed specimen of an internal cast of a left valve, the only one yet seen. Anterior and posterior ends rounded, the latter one most narrowly so; basal line slightly emarginate just behind the middle of its length; cardinal line apparently arcuate throughout. Surface of the shell, as shown on the cast, convex, with a broad sulcus passing across the valve from beak to base, reaching the latter behind the middle. Anterior to the sulcus the surface is radiately ribbed, the rays being somewhat alternate in size over a portion of the space. At the bottom of the broad sulcus there is a single larger and stronger rib, which passes from the beak directly to the base of the shell, which it reaches at the point of greatest emargination. Posterior to this larger rib the surface is destitute of radiating lines, the surface being marked only with broad, irregular, concentric sulci, which extend over the entire surface parallel to the margin of the shell.

This is a peculiarly formed shell, and does not appear to belong strictly to the genus *Pholas*. The only figure of a similar species which I have been able to find in any work to which I have access is that given on Plate 603, Sow., Mineral Conch., under the name *Pholas? compressa*, and so given and retained in all the lists and catalogues to which I have access. The species is from the Kimmeridge clays of Shotover Hill, England, and is not quite half as large as the New Jersey specimen, while it is much broader proportionally and also more strongly ribbed on the posterior part. The shell undoubtedly belongs to the *Pholadidæ*, but certainly cannot be a true *Pholas;* but as there are none of the hinge features present on the specimen, or even the entire external form, I do not think it prudent to suggest a generic name.

Formation and locality.—In the Lower Green Marls at Marlborough, New Jersey. In the collection at Rutgers College, New Brunswick, New Jersey.

Genus MARTESIA Leach.

Martesia (Pholas) cretacea.

Plate XXV, Figs. 20-23.

Pholas cretacea Gabb. Jour. A. N. Sci., new ser., Vol. IV, p. 393, Pl. LXVIII, Fig. 18.
Proc. A. N. S., 1861, 324.
Martesia cretacea Gabb. Proc. A. N. S., 1876, p. 304.

The tubes or casts of tubes from which this species was described are from three-fourths of an inch to one and a quarter inches in length by about three-eighths of an inch in diameter at the larger end of the largest. The basal end is convex and the shaft of the tube regularly tapering. These perforations have been in wood, which is now replaced by pyrite, and none of them show any indications of the shell or markings by which its nature can be determined. There is, however, a specimen in the Academy's collection, marked as of the same species in what appears to be Mr. Gabb's handwriting, which not only shows the general form of the shell but also some slight remains of the surface marking. The former is extremely ventricose, clavate in front, and gradually but rapidly tapering behind, with distinct incurved beaks and a slightly marked mesial line of perceptible width separating the anterior and posterior portions of the valves. The antero-basal area is triangular, and indistinctly marked. Anterior section of the valves marked with strong undulations which have a strongly upward direction from the mesial constriction towards the anterior end, while on the posterior section they are parallel to the margin of the shell. The shell is somewhat exfoliated, and therefore the surface markings cannot be so distinctly made out as it would be desirable.

Formation and locality.—The tubes used in the original description and figured on our plate came from Raritan Bay, New Jersey. The shell, however, is simply marked "Cret. N. J.," like so many of the specimens used by Mr. Gabb, so that one is left in some degree of doubt as to what bed they may have been obtained from

TEREDIDÆ.

Genus TEREDO Linn.

Teredo irregularis.

Plate XXV, Figs. 18 and 19.

Teredo irregularis Gabb. J. A. N. Sci. Phil., new ser., Vol. IV, p. 393, Pl. LXVIII, Fig. 19. Synopsis, p. 174. Meek, Check-list, p. 16; Geol. Surv. N. J., 1868, p. 727.
Comp. *T.* (*Uperotis?*) *contorta* Gabb. Proc. A. N. Sciences, 1861, p. 323.
Polorthus irregularis Gabb. P. A. N. Sci., 1861, p. 366.

Tube, as known by the casts, of rather large size, often exceeding half an inch in diameter and of an undetermined length, extremely contorted and irregular in its direction, and frequently strongly annulated. Shell of proportionally large size, extremely ventricose, and inflated along the dividing ridge, the band on which is proportionally broad. Valves very short and truncated at each end, the basal part being rather sharply pointed. Pallets unknown.

The only examples representing the shells of this species are two imperfect casts of single valves found at the bottom of casts of tubes, and both represent the markings of the inside of the valve. One of them is that described by Mr. Gabb, and is figured on the plate. The other is too obscure to furnish any characters whatever. The casts of the tubes only are known beyond these, and are all very fragmentary. Some of them show evidences of having been divided by vesiculose partitions at irregular distances, and others are strongly annulated with strong projecting lamella at the annulations on the outside of the tube, as if it had been fringed at regular intervals; the fringes projecting into the surrounding material, which, judging from the longitudinally fibrous character of several of them may have been of a woody nature, impregnated in some instances to a depth of an eighth of an inch by mineral matter, which has hardened and preserved a coating to that depth. None of the tubes yet observed preserve the outer extremity, to show if it has or has not been divided by a septum.

This, with the absence of all evidence of pallets or accessory parts, leave no chance of determining to which of the subdivisions of the genus Teredo the species properly belongs.

Formation and locality.—In the Cretaceous of New Jersey, and from the appearance I should suppose from the Lower Marls, but no evidence exists on the labels or in Mr. Gabb's original description of any definite locality.

GASTROCHÆNIDÆ.

Genus CLAVAGELLA Lam.

Clavagella armata.

Plate XXV, Fig 24.

Clavagella armata Morton. Synopsis, p. 69, Pl. IX, Fig. 11. Gabb, Synopsis, p. 109. Meek, Check-list, p. 15. Gabb, Proc. A. N. Sci., 1861, p. 364.

Shell small, the valves being transversely oval, moderately convex, with proportionally large and tumid beaks; their disks marked, especially the right valve, by strong concentric undulations. Right valve free, and the left somewhat distorted in the only specimen which I have before me. Tube small and compressed.

The specimen which I have figured does not show the tubular spines on the anterior margin as mentioned by Dr. Morton. But a small specimen in the collection of the American Museum of Natural History, New York, shows several spines, and I presume they vary considerably in this respect. Dr. Morton's figure shows the existence of these spines on the cast, but the form of the shell as shown there is remarkably elongated and narrowed, as compared with any of those which I have observed. On that which I have figured the muscular impressions are quite marked, showing the shell to have been very much thickened. Judging from Dr. Morton's figure, as well as from the evidence furnished by the specimen here figured, I should infer that the present species would be properly classed under *Stirpulina* Stoliczka, a subdivision of *Clavagella*, in which the tubular spines are confined to the anterior portion of valves, and not scattered along the basal margin also, as in those left under the original name *Clavagella*, although I cannot see where the line of separation between the two sections can be drawn. I should prefer to call them all *Clavagella*.

Formation and locality.—In the Lower Marls at Walnford, Monmouth County, and near New Egypt, New Jersey. Dr. Morton's specimen was collected at Arneytown, N. J., by Mr. Conrad, and it has also been recognized at Prairie Bluff, Alabama. Mr. Gabb speaks of it as occurring at Mount Holly, New Jersey.

SECTION IV.

LAMELLIBRANCHIATA FROM THE MIDDLE MARL BEDS.

OSTREIDÆ.

Genus GRYPHÆA Lam.

Gryphæa vesicularis Lam.

Plate XXVI, Fgs. 9 and 10.

(*For reference and synonymy see ante, page* 36.)

The form of this species, which occurs principally in the Middle Marl Beds, is that which is described on page 37, under the varietal name of *G. aucella* Roemer, or at least very similar. The New Jersey examples do not often have so straight a hinge-line as Dr. Roemer figures. For other remarks see description of *G. vesicularis*, as above referred to.

Gryphæa Bryani, var. **precedens**, n. var.

Plate XXVI, Figs. 7 and 8.

This shell resembles *Oystrea* (*Gryphœa*) *Bryani* Gabb in many of its features, but differs very generally in being prolonged laterally on the left side of the shell as one looks on the smaller valve. Considering this fact, the shells may be said to be obliquely ovate in general outline, but with the left side extended laterally in the lower half. The lower valve is deeply concave, and the beak usually shows a moderately large cicatrix of attachment. The upper valve is concave and similarly extended as the lower. The muscular imprint is of moderate size and irregularly circular, situated back of the middle of the length, usually, and near the side. Cartilage area fairly developed. Lateral margins of the valves strongly crenulated in the upper third of the length and deeply sunken on the larger valve. This variety is not restricted to the Middle Beds, but is perhaps more strongly marked there than among the true *O. Bryani* at the base of the Upper Beds. It seems quite difficult to arrange all these forms under *Gryphœa vesicularis* Lam., and still it is very difficult to point out constant characters of difference. After much study of them with the other forms I am as undecided in my own mind as to their true specific distinction as when I first examined them, and shall therefore retain them as varieties.

Formation and locality.—The particular form here indicated is associated with the small round form of *G. vesicularis* in the yellow sands of the Middle Beds throughout Monmouth County, and also particularly so in the vicinity of New Egypt, New Jersey.

Genus GRYPHÆOSTREA Conrad.

(Am. Jour. Conch., Vol. I, p. 15.)

Gryphæostrea vomer.

Plate XXVI, Figs. 11 and 12.

Gryphœa vomer Morton. Synopsis, p. 54, Pl. IX, Fig. 5. Stoliczka Pal. Ind., Vol. III, p. 457.
Exogyra lateralis (Neils.) Gabb. Synopsis, p. 123. Meek, Check-list, p. 6.
Gryphœostrea lateralis (Neils.) Meek. Geol. Surv. N. J.,1868, p. 724.

Shell of only moderate size, narrowly elongate-oval or elongate-elliptical in outline, strongly arcuate from beak to base, and generally more or less twisted laterally. Right or lower valve deeply concave internally, and the upper one flat or a very little arching with the other. Apex of the lower valve distinctly twisted and often decidedly coiled, and that of the upper distinctly curved anteriorly, although flat. Surface of the lower valve smooth or only slightly lamellose over the larger part of the body of the shell, but often strongly lamellose near the apex, and particularly on the anterior cardinal portion, where it is frequently distinctly auriculate. Surface of the upper valve marked by distant and somewhat regular, elevated, concentric ridges, formed by the free margins of the lamella. Cardinal or ligamental area very small or subobsolete.

This shell has been variously referred to *Ostrea*, *Gryphæa*, and *Exogyra* by different authors, but its general characters do not correspond with the generally accepted features of any of these forms. In Vol. I, p. 15, American Journal of Conchology, Mr. Conrad proposes for a similar Eocene species the generic name *Gryphæostrea*, and in the Report of the U. S. Geological Survey of the Territories, p. 11, Mr. Meek offers a generic diagnosis furnished by Mr. Conrad, and mentions this species as a typical form on Mr. C.'s authority. He also mentions in a foot-note that on well-preserved specimens of this species he has seen long, slender, auricular appendages on each side of the hinge. I have not seen these appendages, to my positive knowledge, except on the anterior side, although they are not uncommon on the anterior side of the lower valve. I think the generic separation of the group of which this may be considered a typical form a necessary one, as it has a decidedly spiral or twisted beak, but without the hinge features of *Exogyra*. This might be said to be an evidence that *Exogyra* and *Gryphæa* ought to be included under one generic division, as this is an intermediate form, which may be quite true, but where there are groups of species having such distinctive characters as this possesses, convenience demands some consideration; whereas many generic divisions are recognized in cases where it is extremely difficult to point out specific differences. The species has been referred to *Ostrea lateralis*, Neils., by several authors. I have not been able to examine specimen of that species, but from the figures which I have seen I should be led to doubt their identity. Oysters, however, are so variable that if one takes the extremes of any of the species from a given locality they would be likely to pass beyond the typical form of one or more other species, so that if we were to follow it out we should soon have but one species in all.

Formation and locality.—The species is very abundant in the Middle Marl Beds, at Timber Creek, and near New Egypt, associated with *Terebratula Harlani*. It also occurs as casts at Mullica Hill, and at localities in Monmouth County, New Jersey, in beds which I suppose to be in the Lower Green Marls.

MYTILIDÆ.

Genus MODIOLA Lam.

Modiola ovata.

Plate XXVI, Figs. 13 and 14.

Modiola ovata Gabb. Jour. Acad. Nat. Sci., Phil., 4, new ser., p. 396, Pl. LXVIII, Fig. 31. Synopsis, p. 143. Meek, Check-list, p. 11.
Perna ovata (Gabb) Meek. Geol. Surv. N. J., 1868, p. 726.

Shell ovate in outline, or elongate ovate, of about a medium size, somewhat alate at the extremity of the short hinge-line. Valves very ventricose, with nearly terminal beaks, which are small, incurved, and not conspicuously raised above the cardinal line. Umbonal ridge prominently rounded, and the surface of the shell in front of it slightly sinuate, giving a slight sinuosity to the basal line; posterior extremity of the shell broadly rounded, and the anterior end narrow. Surface of the shell marked by very fine, obscure lines of growth.

Formation and locality.—In the Middle Marl Bed, at Timber Creek, New Jersey.

Genus MODIOLA Lam.

Modiola (Lithodomus?) inflata, n. sp.

Plate XXVI, Figs. 1 and 2.

Shell small, cylindrically ovate, with large, tumid, anterior beaks, and parallel dorsal and basal margins. Anterior and posterior ends nearly equally rounded in a general view, as the beaks, from their downward direction of curvature as seen in a lateral view, are blended with the anterior margin so nearly as to give almost the same form as the posterior end. In a dorsal view the form is strongly cuneately ovate from the rapid attenuation of the shell posteriorly. Hinge-line rather short and the ligament slender.

This species bears considerable resemblance to *Modiola Johnsoni*, but never attains so great a size, is more cylindrical, with a differently formed beak, and a different surface structure, being smoother and destitute of the strong concentric markings so prominent on that one, and is also more attenuated behind. There are some features about the shell in its general expression which are almost indescribable, but which give it more the appearance of a species of *Lithophagus* than that of a true *Modiola*, and leave an uncertainty about its true generic relations, the specimens being only casts.

Formation and locality.—From Mr. Ware's pits, near Mullica Hill, New Jersey. In the Middle Marls.

PTERIIDÆ Meek.

Genus PINNA Linn.

Pinna rostriformis.

Plate XVI, Figs. 3 and 4.

Pinna rostriformis Morton. Jour. Acad. Nat. Sci. Phil., 1st ser., Vol. VIII, p. 214, Pl. X, Fig. 5. Gabb, Syn., p. 166. Meek, Check-list, p. 9. Geol. Surv. New Jersey, 1868, p. 725.

P. ——— Morton. Synopsis, p. 63.

Shell below a medium size, elongate-triangular in form, with a somewhat attenuated, nearly pointed beak; hinge-line straight and extending nearly the length of the shell; basal margin broadly sinuate along the rostral third of its length, and gently convex beyond that line; posterior margin rounded below and gradually receding above to the extremity of the hinge. Valves very ventricose, subangular along the middle, marked by moderately prominent radii on the upper two-thirds of the surface, and by strong concentric undulations parallel to the lines of growth, becoming quite strong on the basal unradiated area.

All the specimens which I have seen of this species have been imperfect, and all with the external prismatic layers of the shell exfoliated, so that the absolute surface markings have not been observed. The species bears a very strong resemblance to *P. laqueata* Conrad, but is more slender toward the apex, giving a decided sinuosity to the basal line along the rostral portion of the valves.

Formation and locality.—In the Middle Marl Beds, at Timber Creek, New Jersey.

ARCIDÆ.

Genus IDONEARCA Conrad.

Idonearca medians, n. sp.

Plate XXVI, Figs. 5 and 6.

This species very closely resembles *I. vulgaris* in its internal casts, and is very difficult to distinguish in some of its conditions; but the fillings of the cavities of the beaks are very much more elevated, showing that the beaks have been larger and more prominent, and that the cardinal area has been very much wider. The inner line of the hinge-plate seems to have been more arched also than in that species. At some localities this species shows the posterior muscular ridges to be extremely large; while the line of the pallial attachment around the posterior end is remarkably strong, and shows strong cicatrices of attachment in the form of short elevated ridges on the cast, crossing a prominent boss, which, of course, represents a deep depression, with still deeper pits, in the shell at this point. This feature, although existing to some degree in nearly all species of the genus as well as in most Arcas, is in this one remarkably developed. Exterior and shell so far unknown.

Formation and locality.—This species is characteristic so far as yet known of the Middle Marl Beds. The most marked specimens are from Mr. J. S. Cook's marl pits at Tinton Falls, New Jersey.

Idonearca compressirostra, n. sp.

Plate XXVI, Figs. 15 and 16.

Cast of small size, subquadrangular in outline and only moderately convex; beaks small, situated near the anterior end, but very slightly elevated and approximate; anterior end of the shell broadest, the margin abruptly declining from the beaks to near the basal line; basal line moderately arcuate; posterior end obliquely truncate, and narrower than the anterior end; cardinal line highly arched between the beaks and gently declining posteriorly. Muscular scars faintly marked, the anterior one small and indistinct, and the posterior one defined by a faintly impressed line on the lower side, indicating a rather low ridge on the inside of the shell. Pallial line well marked. Hinge features unknown. The median portion on a cast used indicates the existence of several small teeth on this portion. Exterior features unknown.

This is a small and but slightly convex species, and is distinguished by these features from any other of the genus, and also by the very small space between the fillings of the beaks as well as by their small size and slight prominence. The faintly marked muscular imprints might indicate a young shell, but the other features are not what would exist on small specimens of any of the other species known.

Formation and locality.—In the Middle Marl Beds, at Mr. J. S. Cook's pits, Tinton Falls, Monmouth County, New Jersey.

ISOCARDIIDÆ.

Genus ISOCARDIA Lamarck.

Isocardia Conradi.

Plate XXVI, Figs. 3 and 4.

Isocardia Conradi Gabb. J. N. A. Sci., Vol. IV, p. 392, Pl. LXVIII, Figs. 21 and 21*a*.
Glossus Conradi Gabb. Synopsis, p. 162. Meek, Check-list, p. 12.
Bucardia Conradi (Gabb) Meek. Geol. Surv. N. J., 1868, p. 726.

Mr. Gabb describes this shell as follows: "Triangular, equivalve; beaks large, inclined anteriorly; umbones large; anterior margin nearly straight, basal sinuate, posterior subangular below, nearly straight above; surface marked by fine concentric lines." The localities he gives as "Prairie Bluff, Ala., and Timber Creek, N. J."

The only specimen which I have seen of this species is that figured as stated above. The specimen is a cast of the interior, and agrees well with the above description. It corresponds quite closely in form with *I. Washita*, Marcou (Geol. North America, p. 37, Pl. III, Fig. 2), but is more pointed at the anterior extremity and more angular on the umbonal ridge. The specimen from which Mr. Gabb's figures and description are taken is in the cabinet of the Academy of Natural Sciences of Philadelphia, and although labeled as coming from Alabama, I believe to be the one he cites as coming from "Timber Creek, N. J," judging from the lithological characters of the specimen. Consequently, I have copied his figures here, and give the species as a New Jersey form for this reason.

TEREDIDÆ.

Genus TEREDO Linnæus.

Teredo tibialis.

Plate XXVI, Figs. 19-22.

Teredo tibialis Morton. Synopsis, p. 68, Pl. IX, Fig. 2. Gabb, Synopsis, p. 174. Meek, Check-list, p. 16. Geol. Surv. N. J., 1868, p. 727.
Polorthus tibialis (Morton) Gabb. P. A. N. Sci., 1861, p. 366. *Ibid.*, 1872, p. 259, Plate VIII, Figs. 1-7.

The remains for which this specific name was proposed by Dr. Morton consist of long, flexible shelly tubes, varying in thickness from more than a fourth of an inch at the lower end to often less than a sixteenth of an inch at the aperture. They are usually compactly massed together, and form a layer of from four to six inches in depth and of considerable lateral extent at Timber Creek, New Jersey. When densely packed together they are comparatively straight in their direction, but when more loosely arranged they are often bent and distorted into every conceivable shape. Often at the lower end of the layer the tubes are bent and appear to have had a nearly horizontal direction, as though they had come in contact with some hard substance into which it was difficult for the mollusk to penetrate, and it had consequently taken a direction parallel to its surface. When the tubes are carefully examined they are found to be rounded at the bottom, and in rare cases appear to have additional septa, as if the animal had for some reason partially withdrawn from the lower end of its length and formed a new bottom to its burrow. I have never seen more than one of these septa in a tube, but have often seen tubes broken at a septum near the middle of its original length. Mr. Gabb figures one, however, in which he represents three of these septa besides the terminal one. The tubes are more or less irregularly constricted throughout their entire length, giving them a somewhat wrinkled appearance. At the upper end of the tube there is also a series of partial septa, very closely arranged, convex upward, and perforated by an elliptical slit of greater or less size. Six to eight of these dome-like septa are found in the upper quarter of an inch of the tube, while the extremity is often constricted longitudinally, so as to form a double opening. Below the lower dome-like septum there is seen on the casts a double U-shaped or saddle-shaped muscular impression, forming a continuous scar, but with two prolongations upward on the opposite sides and depressions between, the receding parts corresponding to the flattened side of the septal slit.

Mr. Gabb first described the genus *Polorthus* supposing it to be near *Vermetus*, and remarks that "It has never been found burrowing, but grows in aggregated masses of cylindrical tubes, almost always parallel and straight, sometimes five inches long, slightly variable in diameter from irregular constrictions, *contains no shell*, but the tube is divided at certain distances by transverse septa, convex and thin, the convexity pointing toward the widest (or newest) portion of the tube, as if the animal progressed along the tubes, closing the spaces behind it, as in the manner of the *Cephalopoda*, but hermetically." (Proc. A. N. Sci. Phil., 1861, p. 366.) In 1872, in the same journal, p. 259, he again discussed the genus *Polorthus*, and refers it to the Cephalopoda, under the impression that its relations were with that group of mollusks, and considers it nearly related to Orthoceras, etc., from the existence of the septa in the lower end of the tube and the absence of a shell like that of *Teredo*. It is hardly necessary to remark that the reference is very erroneous, and that its relations to the Cephalopoda is entirely imaginary. The genus *Kuphus*, a form of Teredo, does not possess shelly valves, and *Teredo Norvegica*, Spengler, which Tryon quotes as a synonym under *Teredo navium* Sellius, in his list of the *Teredidæ*, Am. Jour. Conch., Vol. 3, possesses the septa at the upper part of the tube to a much greater degree than does *T. tibialis;* neither do these forms always burrow in wood, but frequently in sand, as these have done; still I have seen several specimens of *T. tibialis*, which have burrowed into a black substance resembling lignite, which may have been originally woody. One of these is now in the possession of Mr. G. F. Kunz, of Hoboken, New Jersey. Considering all these circumstances, I see no reason for separating the present species from Teredo.

Formation and locality.—In the Middle Marls at Timber Creek perhaps most abundantly, but also found near New Egypt and many other localities in New Jersey.

GASTROCHÆNIDÆ.

Genus GASTROCHÆNA Spengl.

Gastrochæna Americana.

Plate XXVI, Figs. 17 and 18.

Gastrochæna Americana Gabb. J. A. N. Sci. Phil., new ser., Vol. IV, p. 393, Pl. 68, Fig. 20. Synopsis, p. 124. Meek, Check-list, p. 15.

Polorthus Americana Gabb. P. A. N. Sci., 1861, p. 366. Meek, Check-list, p. 16. Stoliczka, Pal. Indica, Vol. III, p. 15.

This species was described by Mr. Gabb as follows: "Elongated conical; transversely wrinkled; termination of widest end, round." All we yet know of the remains of it consist of the filling of the tubes, which are not uncommon in the yellow limestones at Timber Creek, N. J., but which form extremely unsatisfactory material for description or comparison with other species. These bodies vary much in form and porportions, both in length and diameter, as would be natural with the borings of any species. The extreme in size, so far as I have seen them, is less than three inches in length by about five-eighths of an inch in diameter at the lower end They are very irregular in outline, being marked by numerous transverse wrinkles and constrictions, arising from what has been the rounded base of the tube at different stages of growth, being partially absorbed or worn away during the increase of the tube downwards with the increase growth of the shell. Some of the casts appear almost as if septate, like an *Orthoceras*, and are very regularly tapering; while others are irregularly contorted and constricted so as to resemble an irregular series of cups placed so as to project beyond each other at the edges. No remains of the shell have been found, or even casts of it, so that of this portion we are entirely ignorant. But I think probable were a large collection of the tubes examined by carefully breaking the lower or larger ends, some representation of the shell would be detected. This species has been included by Gabb, Meek, and Stoliczka under the genus *Polorthus* (by the two last authors written Polarthus), but I see no evidence from any of the remains which I have examined of its generic identity with the *Teredo tibialis* of Morton, which is the species upon which the genus *Polorthus* was founded, and I have, therefore, retained it under the genus *Gastrochœna*.

Formation and localities.—In the Middle Marl Beds at Timber Creek, New Jersey. Mr. Gabb also cites it from the "brown marls" of Burlington County, New Jersey, from which place I have not seen them.

SECTION V.

LAMELLIBRANCHIATA FROM THE LOWER LAYERS OF THE UPPER MARL BEDS OF NEW JERSEY.

OSTREIDÆ.

Genus OSTREA Linnæus.

Ostrea glandiformis, n. sp.

Plate XXVII, Figs. 1–5.

Shell small, uniform, lower valve proportionally deep, sometimes profoundly so, and the upper one flat or convex, seldom concave. Cardinal area narrow, but of considerable length and divided by a distinct concave ligamental pit which occupies about one-third of the width in each valve; muscular imprints small and usually inconspicuous. Surface of the shell marked by concentric ridges of growth of greater or less strength, but seldom presenting free lamellose edges. Very faint indications of radiating plicæ are sometimes visible on the lower valve, but never to a degree sufficiently marked to be called plicated. Inner margins of the valves not crenulate.

The species is usually represented only by the internal casts of the cavity of the shell, in which condition they are small, nearly planoconvex, elongated ovate bodies, having the left postero-lateral margin bent upward and are somewhat bean-like in form. The upper side of the cast is usually depressed convex over the central area, and the margins usually bent upward, while the lower side is gibbously convex and irregular, presenting a rather humped appearance.

There are a number of described species which present some resemblance to this one, but none sufficiently similar to be considered as specifically identical; *O. congesta* Conrad is perhaps as near as any, but that one is almost invariably fixed to foreign bodies, while this has been usually free, the casts being found scattered free through the marl, and where the shells are found they present but little evidence of having grown attached, except, perhaps, in their very early stages. Many of them are so convex on the lower valve as to be almost gryphæa-like in form. Still the internal and hinge features are those of a true oyster.

Formation and locality.—In the lower layers of the Upper Marls at Farmingdale, Squankum, Shark River, and near New Egypt, as cast of the interior; and near Vincentown, New Jersey, preserving the shell. Specimens of the shell preserved, but highly pyritous, sometimes occur also at Shark River, New Jersey, but rarely, and are soon destroyed in collections by the decomposition of the pyrite.

Genus GRYPHÆA Sow.

Gryphæa Bryani.

Plate XXVII, Figs. 6–9.

Ostrea Bryani Gabb. Proc. A. N. Sci., Phil., 1876, p. 321.
Comp. *Gryphæa vesicularis* Lam.

The examples upon which this species was established do not appear to me to differ very materially from many of the small forms referred to *Gryphæa vesicularis*, as it occurs in the Terebratula beds of the middle marls; and it certainly does not appear reasonable to place them under the genus *Ostrea*, if we recognize *Gryphæa* as a good generic group, as they appear to possess all the essential features of that genus. The shells which I find marked as the types of Mr. Gabb's species are elongated and very generally somewhat regularly increasing in width from the upper part forward, with sometimes a tendency to lateral extension to the left as one looks on the smaller valve. The lower valve is strongly convex and rather strongly arcuate, while the upper is slightly concave on the exterior. The larger valve has usually a well marked cicatrix of attachment and a moderately developed cartilage area, and the smaller, the latter feature correspondingly large, but nearly vertical to the plane valve. In the feature of lateral extension these shells somewhat resemble the *G. Pitcheri* of the South and Southwest, and on some of the specimens obscure indications of radiating plications occur on the lower valve.

Formation and locality.—The type specimens are marked Vincentown, New Jersey, and are from the collection of the Academy of Natural Sciences, Philadelphia, Pennsylvania. There are also specimens from the same locality in the collection at Rutgers College. These are from the lower layers of the Upper Marls; but the same form occurs in the yellow sands of the Middle Beds, and similar forms are given in many European works as occurring in the chalks of Europe under the name *Gryphœa vesicularis.*

MYTILIDÆ.

Genus MODIOLA Lam.

Modiola Johnsoni, n. sp.

Plate XXVIII, Figs. 8, 9.

Shell small, measuring, in the only perfect example of a cast seen, but little more than an inch in its extreme length. Form ovate, widest behind the middle, and somewhat narrowed anteriorly, while the posterior end is acutely rounded; beaks large, tumid, nearly anterior, slightly enrolled and approximate. Anterior end narrow, the projection scarcely extending beyond the beaks. Valves very ventricose, the umbonal ridge very full and rounded. Ligament short, slender, but distinctly marked; a slight constriction or sulcus marks the basal half of the width of the shell anterior to the middle of its length. Surface of the shell as seen in casts marked by very fine concentric lines parallel to the margin, and also by several varices of growth at irregular intervals.

This species somewhat approaches *M. Julia* Lea's sp., but is not alate posteriorly as is that species, and the posterior end is much more narrowly rounded. It also presents much the appearance of the enlarged figures of *Lithophagus inflatus* herein described, but is less cylindrical, being fuller or more convex on the basal margin and the beaks are not so broad. It also holds a different geological position.

Formation and locality.—In the Dark Green Marls below the Eocene beds of the Upper Green Marls at Farmingdale, New Jersey.

ARCIDÆ.

Genus ARCA Linn.

Arca quindecimradiata.

Plate XXVII, Figs. 10–13.

Arca quindecemradiata Gabb. P. A. N. S., 1860, p. 95, Plate II, Fig. 2. Synopsis, p. 97. Meek, Check-list, p. 9.
A. ?——— (Gabb) Meek. Geol. Surv. N. J., 1868, p. 725.

Shell below a medium size, very inequilateral, transverse, and extremely ventricose, with large, tumid, projecting beaks, situated anterior to the middle of the length; slightly enrolled and very distant, leaving a very broad flattened cardinal area, even in the internal casts. Hinge-line nearly as long as the shell. Posterior margin obliquely truncate and the anterior end rapidly receding from the extremity of the hinge-line, passing with an almost regular curvature into the very broadly curved basal line; posterior basal angle obtusely pointed and situated near the lower side. On the casts the projecting keel, formed along the junction of the valves by the thickening of their borders, is very distinctly marked. Muscular imprints moderately large and well marked; no distinct ridge borders the posterior one, but the cast shows evidence of a decided thickening. Surface of the cast showing evidence of a few strong radiating ribs, the exact number undeterminable.

The casts of this species are very well marked, and are not readily confounded with those of any other species. In the transverse form they correspond with *Idonearca transversa*, but the muscular ridge does not appear; the beaks are larger and more distant and the valves more ventricose. The largest specimens which I have observed do not exceed one inch and one-quarter in extreme length.

Formation and localities.—Mr. Gabb cites his specimens as coming from Mullica Hill, New Jersey. All others which I have seen are from the base of the Upper Marls near New Egypt, New Jersey, and were mostly obtained by Dr. N. L. Britton. Others were in the old collections of the State Survey, and are marked as from John Iron's pits, near New Egypt, and are from the same horizon.

ASTARTIDÆ.

Genus CARDITA Brug.

Cardita intermedia, n. sp.

Plate XXVIII, Figs. 14 and 15.

Form of cast transversely elliptical, or transversely ovate, exclusive of the beaks, largest at the posterior end. Valves very ventricose, with strong projecting beaks, which in this condition are moderately distant. Hinge-line arcuate. Anterior end narrowly rounded; posterior end more broadly rounded; basal margin strongly curved. Muscular scars on the cast small but distinct; margin of the cast showing indications of ten or twelve rather strong radiating ribs between the muscular scars.

This is a very ventricose form, and has had strong, enrolled, subanterior beaks, which have been directed slightly upwards as well as forward. The surface has been marked by strong radiating ribs corresponding nearly to those of *C. perantiqua* of the Eocene marl in strength and number. The form of the shell has been somewhat like that of that species, so far as can be determined from the beautifully preserved cast figured; but the beaks have not been directed so decidedly anteriorly, nor has the shell been so subquadrangular in outline. These features will serve readily to distinguish between the two.

Formation and locality.—In the lower layers of the Upper Marl Bed, at Farmingdale, New Jersey. The specimen is from the collection at Columbia College.

Genus CRASSATELLA Lamarck.

Crassatella Conradi, n. sp.

Plate XXVIII, Figs. 1-5.

Comp. *Crassatella curta* Conrad ? Proc. A. N. Sci., 1862, p. 578. Am. Jour. Conch., Vol. II, p. 104, Pl. VIII, Fig. 2.

Shell, as known from internal cast, small, and of a quadrangular form, with ventricose valves and moderately prominent beaks, which are situated at about the anterior third of the length of the shell, and are somewhat incurved and appressed. Anterior end of the casts short, rounded, but not wide; posterior end much broader, almost squarely truncate or a little oblique to the axis, being longest at the posterior basal angle; basal margin broadly curved. Disk of the valves convex, most prominent near the umbones, and with a prominently angular umbonal ridge and abrupt posterior umbonal slope. Muscular scars proportionally strong and of moderate size; pallial line strongly marked.

I at first thought these casts might be the same specifically as that described by Conrad as *C. curta*, above cited, although he doubtfully supposed his specimen to have come from Virginia. The form is so closely similar, although in a different condition, that it seems difficult to separate them. The specimens are subject to but little variations among themselves in form. They appear a little longer or shorter, and with a more or less sharply angular umbonal ridge. On a single individual in the collection of the American Museum of Natural History, which I have referred to this species with some doubt, there is preserved a small fragment of shell which shows the exfoliated shell at least to have been finely but distinctly radiated. It is possible, however, that it represents a distinct form, as it is somewhat more transverse than any other one examined. Mr. Conrad's *C. curta* is usually referred to the Miocene, but as the locality is very doubtful the formation probably is also.

Formation and locality.—In the lower layers of the Upper Marl Bed, at Shark River, near New Egypt, and at Squankum, New Jersey.

Crassatella Delawarensis.

Plate XXVII, Figs. 14 and 15.

Crassatella Delawarensis Gabb. J. A. N. Sci., new ser., Vol. IV, p. 303, Pl. XLVI, Fig. 20 (=21 of text). Synopsis, p. 112. Meek, Check list, p. 11. Geol. Surv. N. J., 1868, p. 726.

Etea Delawarensis (Gabb) Conrad. P. A. N. Sci., Phil., 1876, p. 275.

Shell below a medium size, cuneately-ovate or subtriangular in outline; beaks moderately elevated and situated considerably within the anterior third of the entire length. Hinge-line rapidly declining toward the posterior extremity, which is narrow and obliquely truncate. Basal margin rather long, straight, or perceptibly hollowed; anterior end short, rapidly declining from the beaks to below the middle of the height, where it has a somewhat tumid appearance. Valves somewhat convex, most elevated on the umbones and slightly sinuous just anterior to the umbonal ridge. This latter feature is somewhat subdued and rounded, and the cardinal slope narrow. On the internal casts the muscular scars are rather small and not so distinctly marked as on most species, and on the cardinal slope there is present a faint ridge between the umbonal angle and the cardinal margin.

The above features are taken from internal casts. I have not seen the shell, but Mr Gabb figures it in the Journal of the Academy of Natural Sciences above cited, and gives it as strongly marked by concentric undulations, while in general form it accords perfectly with the form of the casts which I have seen. Mr. Gabb says it differs from *C. Monmouthensis* in its greater proportional length, smaller umbones, less distinctly marked umbonal ridge, which is lost in the general curvature of the shell before reaching the posterior extremity, and in the secondary ridge, which is seen on the cardinal slope in the internal cast. There is a very close general resemblance in form, however, between the two species, but still they are sufficiently distinct to be readily recognized, even in the condition of internal casts.

Formation and locality.—The internal casts, which are quite numerous in the State collection, are mostly from the pits of John Irons, New Egypt, and other places near by, and also from Poke Hill, and are marked as coming from the lower layer of the "third bed of marl," while Mr. Gabb's specimens were from the deep cut on the Delaware and Chesapeake Canal, in the State of Delaware, which would be from the Lower Marl Bed. It is possible the species may have this great vertical range, but if so it is very different in this respect from most of the associated species, and especially those of this genus. All specimens, however, which I have seen with authentic localities have been from the base of the Upper Marls.

Crassatella littoralis.

Plate XXVIII, Figs. 6 and 7.

Crassatella littoralis Conrad. Am. Jour. Conch., Vol. V, p. 41, Pl. I, Fig. 3.
C. (Conrad). Meek, Geol. Surv. N. J. 1868, p. 731.
C. *pleuronema* Conrad. On label with specimens in A. N. Sci. Philadelphia.

Shell rather below a medium size, transversely oval or ovate, with moderately convex valves and small inconspicuous beaks, which are near the anterior end of the shell and are directed forward. Anterior end wider than the opposite, the greatest width of the valves being across the shell at the position of the beaks. Hinge-line long posteriorly, slightly curved; posterior end narrowed and slightly truncate; basal line gently curved throughout its entire length. Surface of the shell marked by moderately fine, even, concentric ridges parallel to the margin, which are more abruptly bent in crossing the position of the umbonal ridge, this latter feature being very subdued.

In the condition of internal casts, which is the most frequent, the form is transversely ovate, with more prominent beaks, situated considerably within the anterior third of the length and directed forward, incurved and approximate; a perceptible umbonal angle, or with the disk nearly evenly convex; very inconspicuous muscular scars, and a moderately marked furrow along the line of the pallial attachment. The most perfect casts show the margin of the valves to have been finely crenulated.

I have not seen perfect shells, and only a few fragments preserving their substance to any extent, the best one observed being that figured; therefore the hinge features are unknown to me. In form the casts are quite distinct from any of the others recognized in the State and will not be readily mistaken, the transverse oval form, with small incurved beaks, serving to distinguish it. Its nearest allied form is *C. Conradi*, with which it is associated in the same beds. From that it may be distinguished by its greater length, less angular umbonal ridge, less erect beaks, and narrower and rounded posterior end.

Formation and locality.—Mr. Conrad describes the species as from Shark River, and places it under the head of "*Eocene species.*" It, however, occurs, so far as I can ascertain, only in the lowest layers of the Upper Marls, associated with the forms referred to the Cretaceous. It is known from Shark River and Squankum, and doubtfully from Farmingdale, New Jersey.

Crassatella rhombea, n. sp.

Plate XXVII, Figs. 16–19.

Shell of about a medium size for the genus; transversely rhomboidal in outline and proportionally ventricose; the length rather more than one-fourth greater than the extreme height. Beaks large, prominent, and rather distant, situated at about the anterior third of the length. Cardinal margin on the posterior side rapidly declining from the beaks to the postero-cardinal angle, and in front very rapidly declining. Anterior end of the shell neatly rounded from the lower margin of the lunule-like depression to its blending with the regularly curved basal line. Posterior end broadly and obliquely truncate, but with a slightly rounded margin, which unites with the basal line without perceptible angulation. Umbonal angle scarcely marked, although somewhat prominent. Surface of the shell concentrically marked, and also characterized by indistinct radiating lines, which are most distinct near the outer margin. About ten of the radii occupy a space of half an inch on the posterior border of the shell. The largest internal cast of the species which I have observed is about two and a quarter inches in length by nearly one and three-quarters of an inch in height from the basal line to the extremities of the filling of the beaks. The outline of the cast is transversely ovate exclusive of the projections of the beaks, and widest at the posterior end, which is somewhat obliquely truncate, although slightly rounded on the margin. Basal line broadly curved and the anterior end narrowly rounded. Beaks situated a little anterior to the middle of the length, broadly triangular in outline, and projecting considerably beyond the line of the hinge; projections thin, very distant, and not incurved, indicating very ventricose valves with erect beaks, as shown in the example which retains the shell, and which is figured on the plate. Muscular scars moderately large, strongly elevated on the cast, showing deeply impressed scars in the shell; pallial line very strongly marked.

The shell differs in its general form and outline from any American species hitherto described, but quite closely resembles *C. plumbea* Desh., from the Paris basin Eocene, but is rather more ventricose and somewhat shorter. The internal cast differs from all American species in its transverse form and broad posterior end. It most nearly resembles *C. vadosa*, Morton, among those from New Jersey, but is higher posteriorly; has larger, broader, and more erect as well as more distant beak projections, and the valves have been very much more ventricose. The shell appears to be more thickened than is indicated in any of the other New Jersey species.

Formation and locality.—The specimen preserving the shell, a rare case in the marls, is from the base of the Upper Green Marls at New Egypt, and the casts are from Squankum, New Jersey. The former is in the State collection at Rutgers College, and the latter at Columbia College, New York.

CARDIIDÆ.

Genus CRIOCARDIUM Conrad.

Criocardium nucleolus, n. sp.

Plate XXVIII, Figs. 10 and 11.

Shell small, less than half an inch in its greatest diameter, very ventricose, obscurely quadrangular in outline, with nearly central, erect beaks, which are moderately incurved and closely approximate. Hinge-line arcuate; anterior and basal margins united in a single regular curve; posterior end obliquely truncate, a little longer below than above. Surface of the valves somewhat regularly curved from the subangular umbonal ridge to the anterior margin; posterior slope narrow, but abrupt. Muscular impressions distinct and proportionally large. Surface structure and hinge characters unknown, as only casts are known, but the margin shows crenulations indicating radiating ribs.

This species is peculiar among the New Jersey fossils for its small size and rotund form, and I know no described species from other localities that is sufficiently near it in character to be confounded with it. I am by no means positive that it is a *Criocardium* except from its general form, as there are no remains of surface markings, either radiating or concentric, visible on any of the casts examined. There are, however, almost positive indications of crenulations around the margin, on the posterior and postero-basal portions, which would indicate the existence of radii on the shell. For this reason, principally, I have placed it under this genus. *Criocardium speciosa* M. and H., from the Upper Missouri and far western regions, is, perhaps, the nearest allied form, but this one is rather more rotund, a little broader laterally, and the angularity of the umbonal ridge will at once distinguish it. This latter feature would have induced me to place the species under the genus *Protocardia* were it not for the evidence of crenulations on the basal margins of the casts.

Formation and locality.—All the specimens which I have seen are from the lower layers of the Upper Marls, at the Buckelew and Corliss pits, at Farmingdale, New Jersey, and are in the collection of Dr. L. Johnson, of New York City.

CYPRINIDÆ.

Genus VENIELLA Stoliczka.

Veniella rhomboidea.

Plate XXVIII, Figs. 12 and 13.

Venilia rhomboidea Conrad. J. A. N. Sci., new ser., Vol. II, p. 275, Pl. XXIV, Fig. 7.
Gabb, Synopsis, p. 178. Meek, Check-list, p. 13.

Shell rather small, transversely rhomboidal or transversely quadrangular, dorsal and basal margins subparallel, and the posterior extremity obliquely truncate, longest at the postero-basal angle, anterior end rounded. Valves very ventricose, extremely inflated at the anterior and umbonal region; beaks very large and inflated, strongly enrolled, and reaching almost to the line of the anterior border. Posterior cardinal slope very abrupt, the hinge-line imbedded in a broad depressed escutcheon. Umbonal ridge sharply angular. Surface of the casts marked by a few concentric ridges of growth.

This species is represented by two very perfect internal casts, very neat and clean in outline and character, but not preserving any remains of the hinge structure, or other generic features. In its general appearance it very closely resembles *V. trapezoidea* Conrad, and I am extremely doubtful of their specific difference. But that one I only know from a single crushed cast which represents more properly the exterior, while these are strictly internal casts. The only differences which I can see are, that this form is a little shorter and much more ventricose, with, perhaps, larger beaks.

Formation and locality.—In the Green Marls in Burlington County, New Jersey, according to Mr. Conrad. The specimen figured is Mr. Conrad's type, and is borrowed from the collection of the Academy of Natural Sciences, Philadelphia. Other specimens, having the same lithological characters precisely, in the collection at Rutgers College, are from the lower layers of the Upper Marls, below the Eocene layers, and it is probable that the above example is also from the same horizon.

PETRICOLIDÆ.

Genus PETRICOLA Lam.

Petricola Nova-Ægyptica, n. sp.

Plate XXVIII, Fig. 22.

A single cast of a right valve of this species has fallen under my notice. It indicates a shell of only medium size, and proportionally broad from the hinge to the basal margin, with moderately large but not prominent beaks, which have been situated near the anterior end and are directed anteriorly, and which do not rise much above the cardinal line. The shell has been widest anteriorly, and narrows moderately toward the posterior end, which, although the cast is somewhat imperfect at this part, shows it to have been about three-fourths as wide as the anterior, and more narrowly rounded. The cast shows no evidence of surface markings on the shell other than irregular concentric undulations; although, from the distinctness of the marginal line anteriorly, it would appear to have been considerably thickened. The posterior muscular scar on the cast is small, moderately distinct and elongated in the direction of its advancement during the growth of the shell. The anterior scar is not distinctly marked, and its limits are not well defined. Pallial line distinct, the sinus very deep and rounded at the end, which is projected in the direction of the axis of the shell.

Formation and locality.—In the lower part of the Upper Marls, near New Egypt, New Jersey. In the collection at Rutgers College.

MACTRIDÆ.

Genus VELEDA Conrad. 1871.

(Am. Jour. Conch., Vol. VI, p. 74.)

Veleda nasuta, n. sp.

Plate XXVIII, Fig. 23.

Shell of medium size, transverse, about twice as long as high, and moderately convex. Beaks small, appressed, rising but a little above the hinge line, and situated very nearly in the middle of the length of the shell Cardinal line arched, and declining almost equally on each side of the beak, the posterior side, if either, being the most abrupt and less arcuate, the angle formed by the opposite sides being about 135°; basal line less arched than the dorsal, and a little the most ventricose opposite the beaks, while it becomes almost straightened near the posterior extremity. Anterior end of the shell sharply rounded, but a little wider than the posterior, which is narrow and vertically truncate on the margin. Disk of the valves most ventricose on the umbones and along the anterior slope, where it is abruptly rounded. Posterior umbonal ridge slightly angular, and the posterior cardinal slope narrow and abrupt. Surface of the shell only partially preserved, but so far as it exists is seen to be marked by fine irregular lines of growth, with a few stronger undulations of the surface. Interior unknown. Shell substance very thin and fragile.

This species closely resembles *V. transversa* Whitfield in general form, but is not quite as high in proportion to the length; it appears to have been more ventricose, and lacks the even, regular, concentric lining of the surface.

Formation and locality.—In the dark green marls at the base of the Upper Marls, near New Egypt, New Jersey. In the collections of the State survey at Rutgers College, New Brunswick, New Jersey.

VENERIDÆ.

Genus CARYATIS Roemer.

Caryatis? veta, n. sp.

Plate XXVIII, Figs. 16–19.

Bucardia veta Conrad. Am. Jour. Conch., Vol. V, p. 41, Pl. I, Figs. 2 and 3.

Shell small, seldom an inch in extreme length and somewhat less in height, broadly ovate in outline and quite ventricose, with large, prominent, slightly incurved, approximate beaks, which are placed at or just within the anterior third of the length. Hinge line arcuate, rapidly declining from the beaks backward; posterior end of the shell obsoletely truncate and narrowed as compared with the middle of the valve; anterior end narrowly rounded, or obtusely pointed, and with an imperceptibly marked lunule beneath the overhanging beaks; basal line curved, but with an almost inappreciable flattening in the middle. Body of the valves ventricose, without perceptible umbonal angle. Surface of the shell marked by fine concentric lines of growth. The species is seldom seen except as internal casts, in which condition it still retains its general form, but the hinge cavity between the beaks is then quite depressed and broad, and sometimes, from the retention of a part of the shell on the anterior end, presents the appearance of having a deeply marked lunule. On these casts the muscular markings are extremely faint, but of large size, and the pallial line is deeply sinuate and the sinus broad, pointed, and directed obliquely upward in the direction of the lunular area at the anterior end. The hinge features I have not been able to determine any further than that there is evidence of at least two teeth in each valve, and other corrugations representing other features in advance of the beaks. In the only example on which the shell is preserved the ligamental area is coated with foreign matter, so that it is impossible to determine if there is an external ligament or not. The presumptive evidence, however, is that if external at all it was extremely minute.

This is one of several species from the base of the Upper Marl Beds of New Jersey, which have usually been indiscriminately referred to *Cyprina Morrissi* Sowerby, an European species, from the lower Eocene; but as there are two, and most probably three, distinct species among them, probably generically distinct, there is but little likelihood of any of them being specifically identical with that one. The form originally described by Mr. Gabb as *Dione Delawarensis* differs from this one in its more elongate and more regularly oval form. Mr. Conrad, in the Am. Jour. Conch., Vol. V, Pl I, Fig. 6, gives a figure of a shell which he identifies with Mr. Gabb's species, but I think wrongly, although the figure is too poor to afford conclusive evidence. This, and at least one other associated form, appears to me most likely to prove to possess the features of Roemer's genus *Caryatis;* in fact Mr. Conrad has stated that the other one which he refers to, *C. Delawarensis=Dione Delawarensis* Gabb, possesses the hinge structure of that genus, and certainly the general form, rotundity, muscular and pallial markings correspond very closely. They might also with nearly equal propriety be placed under Sowerby's genus *Thetis*, except for the want of the notch in the pallial sinus.

Formation and locality.—The species appears to be common in the lower (Cretaceous) layers of the Upper Marls at Farmingdale, Squankum, New Egypt, and at Shark River, New Jersey, and is often found associated in collections with the fossils from the upper or Eocene layers, but I cannot ascertain that it is ever found in these beds.

SAXICAVIDÆ.

Genus PANOPEA Ménard.

Panopea elliptica, n. sp.

Plate XXVIII Figs. 24 and 25.

Shell, as known from the internal cast, transversely elongate, having been fully once and a half as long as high, with narrowly rounded extremities, very ventricose valves, and moderately elevated beaks, which appear to have been directed toward the posterior end of the shell. Anterior end widest, and rather narrowly rounded on the extremity; posterior end suddenly narrowed on the dorsal line near the beaks, the line of the hinge being concave; extremity of the valves narrow and scarcely truncate on the margin, with an indistinct umbonal geniculation of the striæ; basal line convex, with a broad and undefined sinuosity behind the middle of the valve. The extremities seem to have been widely gaping, the valves only being in contact near the middle of the basal margin. Surface of the cast marked by broad undulations, indicating similar undulations on the surface of the shell parallel to the margin of the valves. Hinge features and muscular markings unknown.

Only very imperfect fragments of internal casts of this species have been seen; the best of which is that illustrated. The species differs from *P. decisa* Conrad, which occurs in the lower beds, in the narrower extremities, especially the posterior end, which lacks the broad oblique truncation so characteristic of that species. The beaks are also proportionally larger, and the posterior cardinal line more deeply excavated behind them.

Formation and locality.—In the dark green sands at the base of the Upper Marls, near New Egypt, New Jersey, and is apparently an uncommon species.

ANATINIDÆ.

Genus PERIPLOMYA Conrad.

Periplomya truncata, n. sp.

Plate XXVIII, Figs. 20 and 21.

Shell of medium size, transversely elliptical in general outline, and proportionally ventricose, with subequal valves; in the cast, the condition under which the species is known, the beak of the right valve appears the largest and most prominent. Beaks full, but of small size, turned toward the posterior extremity, and not projecting much beyond the hinge margin, their location being perhaps a little behind the middle of the shell's length. Length of the shell about twice the height; anterior end rather sharply rounded and wider than the opposite, the anterior cardinal border being very slightly arched; basal line broadly and evenly curved; posterior end narrowed from behind the beaks, and the posterior cardinal margin concave, abruptly so near the beaks; posterior extremity truncate. Umbonal ridge angular, the disk of the valve in front of it being full and ventricose, while the posterior cardinal slope is concave. Surface of the cast marked by a few undulations of growth. Muscular impressions small and faintly marked.

This species might readily be mistaken for a cast of *Periplomya elliptica* Gabb, from the Lower Marls, as it very closely resembles it, but on close comparison it is seen to be wider posteriorly, and not so pointed at the extremity; the anterior end is proportionally less, and the beaks situated nearer the middle of the length, while the valves are more ventricose, especially in the vicinity of the beaks.

Formation and locality.—In the dark-colored marls at the base of the Upper Marls, near New Egypt, New Jersey. Collection at Rutgers College.

SECTION VI.

LAMELLIBRANCHIATA FROM THE EOCENE MARLS OF NEW JERSEY.

OSTREIDÆ.

Genus OSTREA Linnæus.

Ostrea glauconoides, n. sp.

Plate XXIX, Fig. 2.

Shell small, obliquely ovate, lower valve rather shallow, narrow at the apex on the body of the valve, but with a proportionally large wing on the inner (anterior ?) side, which gives the cast a somewhat Avicula-like aspect. Lower part of the valve abruptly curved to one side, which, if the larger valve shall be called the right, would be anterior, the same as the alated side of the hinge, and is somewhat prolonged at this point. Muscular impression faintly marked, but broad, and near the middle of the valve. Surface of the shell, as indicated on the cast, marked by rather strong, rounded, radiating ribs.

Only a single cast of a valve of this species has been noticed, but it differs so greatly from any other one in these beds, or even in the New Jersey formations, that it cannot be easily mistaken. It seems to have an extension of the hinge on each side of the beak, but this point cannot be very well determined from the specimen under examination. There are several small species of *Ostrea* in the Eocene which more or less resemble this one, like *O. Alabamiensis* Lea, from Claiborne, but none of them are near enough to be mistaken for it, and as this one is so marked and quite uncommon, it is well that attention should be called to its existence in these layers. This same species occurs in the white marly limestone at or near the base of the Eocene beds at Claiborne, Ala, where it attains a size nearly twice the length of that here figured, and presents the features indicated on this cast, but intensified; the ribs being strong and rounded, and the alation of the hinge well marked; the curving of the shell toward the front is also very marked. I cannot find that the Claiborne shell has ever been described or indicated by name. It may have been confounded with the young of *O. sellæformis* Conrad, to which it bears considerable resemblance, but that species in its young state, and even in its more advanced stages, never has the lateral curvature nor the strong ribs; although the hinge alation is quite strongly marked and the surface ribbed The ribs, however, are much finer and the shell proportionally broader and shallower. The species differs from all other oysters of the Eocene to which I can find reference in the curving shell, combined with the alation of the hinge.

Formation and locality.—In the upper bed of the Upper Green Marls at Shark River, New Jersey.

Ostrea (Alectrionia?) linguafelis, n. sp.

Plate XXIX, Fig. 1.

This single cast of the lower valve of an oyster-like shell is figured from the Eocene marls. At first I was inclined to refer it to *O. larva* Lam., but on close observation I find that it possesses characters which are incompatible with that species, and which make it necessary to distinguish it by a distinct name, although from the poor material in hand I was disinclined to do so.

The form is very obliquely elongate-oval, with a comparatively long cardinal line, apparently auriculate on one side, which, although imperfect, seems to have been extended in the form of a wing. Body of the valve convex, and the surface, as shown on the margin of the cast, marked by comparatively small radiating plicæ. Cardinal area small and the ligamental area narrow and obscure. Muscular scar rather small, and situated above the middle of the shell's length.

Formation and locality.—In the upper layers of Green Marl at Shark River, New Jersey. Collection at Rutgers College.

Genus GRYPHÆA Lam.

Gryphæa vesicularis Lam.

Plate XXIX, Figs. 7 and 8.

For references and synonyms see page 36.

It is generally supposed that the genus Gryphæa does not occur in beds above the true Cretaceous, hence I have hesitated somewhat before referring the single specimen of an internal cast figured on Plate 39, Figs. 7 and 8, to *G. vesicularis* Lam. But on critical examination I can find no reason to doubt the truth of the reference. The form and character of the specimen are precisely those which would be given by the internal cast of one of the small variety of the species as they occur in the marls of the middle beds, with the exception of the more marked extension of the siphon-like protuberance on the side, in which respect it corresponds more closely to the form of the larger individuals from the Lower Marls. The muscular scar on the specimen is well marked, and all the features are those of an old and much-thickened shell in which the rostral cavity has become filled by excess of thickening; and I can see no reason whatever for not considering it as identical generically and specifically with the shells from the Cretaceous marls below. There can be no question as to the authenticity of its locality and position, as, fortunately, the specimen bears on the under surface an imprint of *Cardita perantiqua* Con., which at once fixes the position beyond question. It is possible that this may be a Cretaceous specimen broken from its original bed and redeposited in the Eocene seas. If so, however, it is the only case yet known in the State.

The example is from the upper layer of the Upper Marl at Shark River, New Jersey.

PECTENIDÆ.

Genus PECTEN Klein.

Pecten Kneiskerni.

Plate XXIX, Figs. 3–5.

Pecten Kneiskerni Conrad. Am. Jour. Conch., Vol. V, p. 40.

Mr. Conrad's description of this shell is as follows: "Ovate, convex, ribs 13, convex, little prominent; anterior and posterior submargins without ribs; ears equal. (Cast.)"

Mr. Conrad's description seems to have been made from a cast of a small left valve, on which the radii were less numerous than usual. Among the casts and impressions which I have examined from these beds in New Jersey I find no evidence of more than one species, although if the difference in number of ribs be taken as evidence of specific characters, there might easily be two or even three species founded upon those which are now before me, as one individual, an external imprint, half an inch long, shows twenty-nine ribs on the body of the shell, while another, also an external imprint, only two-thirds as large, shows thirty-eight. The larger right valve figured, which is from a gutta-percha impression of an external imprint, shows fifty ribs when those on the submargins are counted. An internal cast of a left valve of nearly equal size to the last shows only about twenty-five ribs which are less distinctly elevated, being low and flattened, those on the submargins being lost, while all those added interstitially on the exterior are lost on the internal cast.

The shell, as I find it represented by casts of the interior and imprints of the exterior, is subdiscoidal, or suborbicular in general outline, with moderately and generally evenly convex valves, and moderately sized ears, the anterior one on the right valve being slightly longer than the posterior, distinctly separated from the body of the shell by a deep, narrow sinus; posterior ear rapidly sloping from the hinge line and joining the body of the shell below much farther from the central line than its length on the hinge line. Hinge line straight on both valves and about half as long as the antero-posterior length across the body of the shell below. The left valve has ears about equal to those of the right valve, but without the anterior sinus. Body of the shell abruptly and distinctly elevated above the plane of the auriculations along the submarginal slopes. Radii sharply elevated, rounded on top, and separated by equally sharp, rounded depressions, increased by implantation, but not frequently enough to prevent this rapid increase in strength as the shell increases in size, numbering from fifteen on young shells to fifty on larger individuals Surface marked by concentric striæ, very fine and even on the body of the shell, but stronger, more elevated, and more distant on the lateral portions of the shell. Ribs stronger in the middle of the shell and finer on the sides. Auriculations marked by rays and strong concentric striæ.

The species somewhat resemble *P. tenuitestus* Gabb, from the lower marls, in its surface markings, but is proportionally broader across the body of the shell. The young specimen, especially those with fewer ribs, are very similar in form and general appearance to *P. venustus* Conrad, also from the lower marls, but they have usually a greater number of ribs.

Formation and locality.—In the upper layers of the Upper Marls at Shark River. All the specimens which I have seen are from the collection at Rutgers College, except one, figured, which is in the collection of the Academy of Natural Sciences of Philadelphia.

Pecten Rigbyi, n. sp.

Plate XXIX, Fig. 6.

Shell small, circular in outline exclusive of the auriculations, and moderately ventricose on the right valve; ears rather large, the anterior one nearly twice as long as wide, and the byssal notched below it deep; posterior ear nearly or quite as long, but shorter on the hinge-line than where it joins the body of the valve, making the hinge-line a little more than half as long as the width of the body of the shell below. Surface of the shell marked by from twenty-two to twenty-six radiating ribs, which are strong in the middle of the valve and gradually decrease in strength toward the sides. Surface of the ribs crossed by very distinct, imbricating, concentric lamellæ. Auriculations on the right valve both marked with radiating ribs and comparatively strong concentric lamellose lines. Left valve unknown.

This species is associated with *Pecten Kneiskerni* Conrad, but may be distinguished from that one by the comparatively coarser radiating ribs.

Formation and locality.—In the upper layer of the Upper Marls, at Shark River, New Jersey.

Avicula annosa Conrad.

Plate XXIX, Fig. 9.

Avicula annosa Conrad. Am. Jour. Conch., Vol. I, p. 214, Pl. XX, Fig. 16. Smithsonian Check-list, Eocene Fossils, p. 4. Meek, Geol. Surv. N. J., 1868, p. 731.

The typical specimen of this species is before me, but it is such an imperfect cast that it is difficult to determine satisfactorily as to its true nature. In some lights it presents the appearance of a cast of an oyster, while in the position in which it was figured by Mr. Conrad it may readily be viewed in the light of an *Avicula*=*Pteria*. But after studying the specimen and examining it in every position I have come to the conclusion that it is only a fragment of the outer volution of one of the large nodose *Fasciolaria*-like shells common in the same beds. If one hold the specimen in a position so as to bring what Mr. Conrad interpreted as the extremity of the posterior hinge-line to the bottom of the specimen, this is at once seen to be the true interpretation of the fragment, that part being a portion of the beak or rostral portion of the shell, and the protuberances, which in the *Avicula* interpretation represent the beak and anterior lobe or wing, are only two of the nodes on the body of the volution. The name *Avicula annosa* Conrad ought therefore to be dropped from zoölogical nomenclature.

The specimen was from Shark River, and came from the upper layers of the marl at that place.

NUCULIDÆ.

Genus NUCULA Lam.

Nucula Circe, n. sp.

Plate XXIX, Fig. 12.

Shell rather above a medium size, very broadly ovate or subtriangularly-ovate in outline, with subcentral beaks, and the hinge-line sloping from it nearly equally on each side, inclosing an angle of about 110°. Posterior side of the hinge longest and somewhat arcuate, containing fourteen teeth, with considerable space near the beak unseen, probably containing about six additional ones. Teeth regularly increasing in size posteriorly. Anterior side not observed; basal line gibbous in the middle, leaving the anterior and posterior ends nearly equally pointed. Muscular imprints small, but moderately distinct. Surface of the shell marked by fine radiating striæ, most strongly marked on the anterior half of the valve.

The only specimens of the species observed are flattened by compression, and possibly somewhat distorted also, although of this there is no direct evidence. The valves appear to have been quite convex, although not so now. If no distortion has taken place, the form would be quite different from any known species. In size it corresponds to *N. Slackiana* Gabb, from the Lower Marls, and also to *N. magnifica* Conrad, from the Eocene sands of Claiborne, Ala., but in its proportions of form it differs from either very materially.

Formation and locality.—In the upper layers of the Upper Marls, at Shark River, New Jersey.

Genus NUCULANA Mörch.

Nuculana albaria.

Plate XXIX, Figs. 15 and 16.

Yoldia protexta Conrad. Am. Jour. Conch., Vol. I, p. 213, Pl. XXI, Fig. 2. Meek, Geol. Surv. N. J., 1868, p. 731. Conrad, Check-list, Eocene Foss., p. 4.
Y. albaria Conrad. Am. Jour. Conch., Vol. III, p. 8.
Not *Yoldia protexta* Gabb.

Shell of medium size, transversely elongate-elliptical, varying from considerably less to a little more than twice as long as high, and the opposite ends of the shell nearly or quite of equal length, although differing materially in height. Narrow end of the shell recurved and obtusely pointed; opposite extremity more broadly rounded; base nearly equally curved throughout. Beaks small and appressed. Hinge-line marked by about twenty somewhat curved teeth on the broad side of the shell, and by twenty-three or twenty-five on the pointed end; ligamental pit of considerable size. Surface of the shell marked by very fine even striæ of growth.

Mr. Conrad first described this shell under the name *Yoldia protexta*, but subsequently changed it to *Y. albaria* on ascertaining that Mr. Gabb had already used that name for a Cretaceous species. The casts very closely resemble those of *Y. protexta* Gabb, so much so that it is difficult to point out differences. The shell is, however, more equilateral and appears to have been a trifle higher and to have been less recurved at the narrow end; otherwise they are strikingly similar. Mr. Conrad's figure in the American Journal of Conchology is very poor, and represents the narrow end of the shell as much longer in proportion to the other than in any specimen which has come under my observation. He also describes it as "anterior side longest." I have placed this and the others under the genus *Nuculana* from the fact that I have not been able to detect any "*largely sinuate pallial line*" on any of the casts, and because the cartilage pit beneath the beak is *small* instead of *large*. These two features appear to be about the only distinction there is between *Nuculana* and *Yoldia*, and as these agree most nearly with the former, which is also the oldest genus, I have adopted that name in preference to the other. The cartilage pit in the present species is reduced to its minimum size, being so small as to require magnifying in order to see it distinctly, while the teeth near the center of the line are also extremely minute.

Formation and locality.—In the top layer of the Upper Green Marls, at Shark River, Farmingdale, and Squankum, New Jersey.

Genus NUCULARIA Conrad.

Nucularia secunda, n. sp.

Plate XXIX, Figs. 13 and 14.

Shell small, very inequilateral, transversely elongate, and very elongate-ovate or subelliptical in outline. Cardinal and basal lines subparallel, the anterior end being a little the widest. Beaks small, situated at about one-fourth the length of the shell from the anterior end. Anterior extremity of the shell sharply rounded; posterior end narrower and rounded; basal line broadly but regularly curved; posterior hinge-line very slightly concave. Disk of the valve gently depressed-convex, the shell apparently somewhat gaping posteriorly. Hinge-line marked by a moderately large triangular pit beneath the beak, and by about eight pectenoid teeth on the anterior side of the beak, and about thirteen or fourteen on the posterior side; those of both parts gradually increasing in size from the beak outward. Surface of the shell unknown.

The shell is known only by internal casts, in which condition it very closely resembles *N. papyridea* Conrad, from the base of the Cretaceous marls at Haddonfield, N. J.; the form is, however, not quite so robust, being narrower in proportion to its length, and the posterior end is rounded instead of being obliquely truncate, as in that one, which gives a more regular curve to the basal line. This species throws a little more light on the characters of this genus than was known from the Cretaceous species, as in the example figured on the plate, the entire hinge features can be made out. These show that it is so very closely related to *Nuculana* as herein used that it becomes a question if *Nucularia* should be retained as a distinct genus. It is possible there may be some more distinctive feature in the arrangement of the muscles, or in the form of the pallial line, as these features are not observable on the specimens; but so far as the characters of the hinge-plate can be relied upon, I should not consider it a valid genus.

Formation and locality.—In the upper layers of the Upper Marls, at Shark River, New Jersey.

Genus AXINEA Poli.

Axinea Conradi, n. sp.

Plate XXIX, Figs. 10 and 11.

Shell small, the internal cast measuring a little less than one inch in height, and is a trifle narrower than high. Valve depressed-convex, most strongly convex above the middle, and gradually sloping below. Outline nearly circular, equilateral, and slightly pointed at the beak in the cast, but the outline of the hinge-plate would give a more circular form. Hinge-plate narrow, marked on the anterior side by about eight short oblique teeth; opposite side unknown. Muscular scars rather small. Exfoliated surface marked by moderately fine, distinct, rounded striæ. The margin denticulated to correspond.

The species differs from *A. Mortoni* Conrad, from the Lower Marls, in being less convex, and in being most convex above the middle, whereas that one is evenly rounded. It also differs in being higher than wide, that one being the opposite, and in being more finely denticulate on the margin of the cast. These differences I deem quite specific in forms of this genus.

Formation and locality.—In the upper, stony layers of the Upper Marl Bed, at Shark River, New Jersey.

ASTARTIDÆ.

Genus ASTARTE Sowerby.

Astarte castanella, n. sp.

Plate XXX, Figs. 1 and 2.

Crassina? veta Conrad. Am. Jour. Conch., Vol. V, p. 41, Pl. I, Fig. 5.
Not *Astarte veta* Conrad. Am. Jour. Conch, Vol. IV, p. 279, Pl. XX, Fig. 4, or Vol. V, p. 227.

Mr. Conrad describes this species in the following words: "Triangular, inequilateral, convex; posterior dorsal margin straight and oblique; anterior extremity angular and situated much above the line of the ventral margin, which is crenulated within; cardinal pit under the apex of the left valve, triangular, wide, oblique. (Cast.) *Locality*, Shark River, N. J."

I have seen only casts of this species, and do not think it has been recognized under any other form. There are two forms associated with each other so nearly alike that it is somewhat difficult to distinguish between them; yet I believe them to form two distinct species. One of the marked features of this one is its crenulated basal margin, which is the only feature that would enable one to say to which Mr. Conrad's description applies. The form is more transverse than that of the other, sometimes becoming almost elliptical in outline inside of the impression of the beak and hinge-plate. The posterior end is also more distinctly truncate, with a slight umbonal angle, and the anterior end somewhat longer proportionally. The margin of the valve is strongly, and for so small a shell almost coarsely crenulated, while that of the other is smooth.

This being a true *Astarte*, and Mr. Conrad having previously described an *Astarte veta* in Vol. IV, Am. Jour. Conch., p. 279, and Vol. V, p. 227, his specific name *veta* cannot stand, consequently, from its very close resemblance to the recent *A. castanea*, I change it to *A. castanella*.

Formation and locality.—In the top layer of the Upper Green Marls (Eocene) at Shark River, Farmingdale, and Squankum, New Jersey.

Astarte planimarginata, n. sp.

Plate XXX, Figs. 3 and 4.

Shell small, triangular, with sharp, pointed, incurved beaks, which almost overhang the anterior end. Length seldom exceeding half an inch, with about an equal height. Body of the shell below the beaks, as seen in the cast, broadly round-triangular, and most convex just below the umbonal region. Cardinal margin slightly curved behind the beaks and concave in front; basal line curved and passing imperceptibly into both the anterior and posterior margins. Imprint of the hinge-plate broad and proportionately large. Muscular imprints of moderate size and faintly marked. Inner margin of the valves destitute of crenulations.

This species differs from *A. castenella* Whitf. (=*A. veta* Conrad) in being more distinctly triangular in the proportionally larger and more prominent beak and broader hinge-plate, in the want of the posterior truncation of the margin, and the absence of umbonal angle, and in the smooth inner margin of the valves, that one being strongly crenulate. In form this shell strikingly resembles young specimens of *Astarte castanea* of our Atlantic coast.

Formation and locatity.—In the top layer of the Upper Green Marls at Shark River, Squankum, and Farmingdale, New Jersey (Eocene).

Genus CARDITA Brug.

Cardita perantiqua.

Plate XXX, Figs. 8–10.

Cardita subquadrata Gabb. J. A. N. Sci., Phil., new series, Vol. IV, p. 303, Pl. XLVIII, Fig. 22 *a*, *b* (by error on Pl. XXI). Synopsis, p. 105. Meek, Check-list, p. 11. ? Lea, Proc. A. N. Sci., Phil., 1861, p. 150.

Venericardia perantiqua Conrad. Am. Jour. Conch., Vol. I, p. 8. Meek, Geol. Surv. N. J., 1868, p. 731.

Not *Cardita subquadrata* Conrad. J. A. N. Sci., new series, Vol. I, p. 128, Pl. XIV, Fig. 9.

Shell of medium size, with moderately convex valves and an obscurely subquadrangular outline. Beaks fairly large, but not prominent, and scarcely projecting above the cardinal line, but directed well anteriorly and enrolled. Anterior end of the shell excavated in front of the beaks, rather sharply rounded, and somewhat projecting beyond the beaks; basal line moderately arcuate, and subparallel with the cardinal margin, which is straight and only a little shorter than the length of the shell behind the beaks; posterior end broad and squarely rounded, being nearly at right angles with the cardinal line. Umbonal ridge scarcely marked. Surface of the shell marked by strong, radiating plications, which are strongest on the anterior end and faintest and more closely arranged on the postero-umbonal slope. On the shell, or, as obtained by gutta-percha casts, in an outside imprint of the shell, the surface of each rib is seen to be highly crested, and to be composed of three ridges, a central or highest one and a smaller and more obscure one on each side, with a moderately concave surface separating the different sets. The ribs on the body of the shell and on the anterior end are often covered along their crests with a series of nodes, formed by the concentric lines of growth which thickly cover all parts of the shell. In the number and strength of the ribs the specimens vary greatly. In the coarser forms there are fifteen to twenty ribs, and on the finer ones twenty-five or more, but they do not appear to be distinctive specifically, as there are all grades between them.

The species is very abundant, and forms the most common and most prominent fossils of the beds in which it occurs. In its general form it is perhaps as near *C. rotundata* of the Claiborne, Ala., beds as any American species, but the ribs are coarser, and it differs in the surface markings and in its more distinctly subquadrate outline.

Formation and locality.—In the Green Marls at the top of the third bed, associated with other Eocene fossils, at Farmingdale, Shark River, near Monmouth, and other places. Mr. Gabb first described it from Monmouth County, New Jersey, as *C. subquadrata*, but as Mr. Conrad had previously given this name to a very different form from South Carolina, it became necessary to change it, which Conrad did in his list of Eocene fossils published in Vol. I, American Journal of Conchology.

Cardita Brittoni, n. sp.

Plate XXX, Figs. 11 and 12.

Shell somewhat below a medium size, nearly circular in outline, but in the condition of internal casts broadly oval transversely within the line of the beaks. These latter are very large, prominent, moderately distant, and inclined forward, but not much incurved, and are placed considerably in advance of the middle of the shell. Body of the valves very ventricose, becoming almost inflated on the umbones, and destitute of any angulation in the posterior umbonal region. Anterior end moderately projecting and narrowly rounded; posterior end more broadly rounded, and the basal line forming a segment of a regular ellipse. Surface of the casts destitute of plications when found in hard marl, except faint indications of those seen just at the margin along the basal line. On casts from the softer marls, where they partake partially of the exterior characters, they show from twenty-two to twenty-six radiating ribs, which are narrow and sharp, with much wider interspaces; and in these specimens the beaks are sharper and incurved, being nearly in contact. On the internal casts the muscular scars are small, but rather well marked.

This species is somewhat smaller than *C. perantiqua* Conrad, and differs from it in its finer ribs, of which there is a greater number, that one having from sixteen to eighteen. They are apparently associated together in the same layers, and will generally be looked upon as one unless where carefully studied; but in the condition in which the external ribs are shown these are so much finer that there will be little difficulty in separating them It is possible they ought to be considered only as varieties of the one species, but I have seen no intermediate forms as yet to connect them.

Formation and locality.—In the topmost layer of the Upper Green Marls at Squankum and Shark River, New Jersey (Eocene).

Genus CRASSATELLA Lam.

Crassatella alta.

Plate XXIX, Fig. 17.

Crassatella alta Conrad. Foss. Shells of the Tertiary, p. 31, Pl. VII. Am. Jour. Sci., 2d ser., Vol. I, p. 395, Pl. III, Fig. 1. Am. Jour. Conch., Vol. I, p. 10. Check-list, Eocene, p. 5.

A single very imperfect cast which appears to be of this species occurs in the collections from Shark River. Its erect form, prominent and nearly central beaks, and slight posterior umbonal angle all agree well with the same features on the specimens from Claiborne, Ala., so far as a cast can be said to agree with the external shell. The regular curvature of the anterior, basal, and posterior margins, which blend into each other without perceptible angulation, is also a marked feature, and one not observed in any other American species. So that I feel no hesitation in considering it as identical with the Claiborne examples.

Formation and locality.—In the upper layers of the Upper Marls at Shark River, New Jersey.

Crassatella obliquata, n. sp.

Plate XXIX, Fig. 18, and Pl. XXX, Figs. 13 and 14.

Shell, as known from internal casts, large and apparently of considerable thickness, especially in the cardinal portions, sometimes measuring nearly three and a half inches in length by fully two and a half in height. Valves moderately convex, although the casts generally show evidence of considerable compression. Outline obliquely ovate, with very broad and extended beak or rostral processes, which are broadly triangular in form and pointed obliquely upward and forward. Anterior end short and narrow; posterior end broader and obliquely truncate, much longer in the postero-basal region than above; basal margin strongly curved; muscular scars large and moderately strong; pallial line usually distinct. Surface of shell and hinge features unknown.

This shell in its form, as shown by the casts, has differed from any other species of the genus known in its large size, ventricose valves, and oblique form combined. The beaks must have been very prominent, as shown by the very large processes which have filled their cavities, much larger, in fact, than in any other known species, while at the same time they have had a very considerable breadth. Its general features are so distinctive that when found presenting anything like its normal form it can scarcely be confounded with any other species. But most of them have suffered distortion in the marls to so great an extent as to almost obliterate their original shape.

A cast of a single valve, showing the imprint of the hinge-plate has been obtained since the above description was written. The plate is wider in proportion than that of *C. alta* Conrad, from the Claiborne, Ala., Eocene beds, and is situated nearer to the anterior end of the shell than in that species, showing the obliquity of the body of the shell to be its normal condition, and proving its specific distinction. The different elements of the hinge have much the same characters and proportion to each other as have those of *C. alta*, but the plate is higher from the inner margin to the apex of the beak in proportion to the antero-posterior diameter. This feature, with the fact that a much larger part of the body of the valve is posterior to the central line of the hinge-plate, will readily serve to distinguish the species from that one if it should ever be found with the shell preserved.

Formation and locality.—The only examples which I have seen have been from the top layers of the Upper Marl Beds at Shark River, New Jersey.

CARDIIDÆ.

Genus PROTOCARDIUM Beyr.

Protocardium curtum.

Plate XXX, Figs. 5–7.

Protocardia curta Conrad. Am. Jour. Conch., 1870, Vol. V, p. 42, Pl. I, Fig. 1. Meek, Check-list, p. 731. (Antedated, description first published 1870.)

Shell of medium size, subquadrangular in outline, with nearly equilateral and moderately convex valves. Beaks large, prominent, posterior to the middle of the shell, and incurved; cardinal line strongly arcuate, parallel to the basal line, and nearly equally curved, the basal line curving abruptly upward at, and blending imperceptibly into the anterior end, this latter being narrower than the posterior. Posterior margin abrupt, slightly oblique, being just within a right angle with the postero-basal line. Umbonal angle sharply defined, and the posterior slope narrow and abrupt. The surface of the shell has been marked throughout by fine, radiating striæ, of which seven or eight may be counted in the space of an eighth of an inch on the margin of a specimen measuring nearly one and three-fourths inches in height. On the posterior slope the striæ are somewhat coarser than on the body of the shell. The hinge, as seen on a very well-preserved cast of a right valve, has been characterized by a strong lateral tooth on each side and a single strong, hook-like tooth in the center beneath the beak, with a similarly-shaped cavity in front of it, presenting a true *Cardium* hinge. The plate for the attachment of the ligament, however, cannot be made out. The muscular scar on the anterior side has been very faint, seldom being seen on the cast, but the posterior scar has been deeper, and sometimes leaves a deep groove bordering it on the cast, representing a ridge on the shell.

The species presents the external form of a *Protocardium*, but differs somewhat in the surface markings, as it is striated throughout. Mr. Conrad described the "ventral margin minutely crenulated," but on some of the casts the striæ on the body of the shell can be traced to near the middle of the valve, showing that they are the remains of external striæ, and not merely the crenulations of the internal margins of the shell. I have not seen the external markings in imprints of the shell, as there appears to have been none of these preserved in collections. The representation of the hinge of a left valve is given on the plate as nearly as it could be obtained from a gutta-percha impression taken in the best cast which I have observed.

Formation and locality.—In the Eocene layer of the Upper Marls at Farmingdale, Squankum, and Shark River, New Jersey. Apparently not a rare species.

VENERIDÆ.

Genus CARYATIS Roemer.

Caryatis ovalis, n. sp.

Plate XXX, Figs. 15 and 16.

Caryatis Delawarensis Conrad. Am. Jour. Conch., Vol. V, p. 41, Pl. I, Fig. 6.
Not *Dione Delawarensis* Gabb. J. A. N. Sci., new ser., Vol. IV, p. 312, Pl. XLVIII, Fig. 18.

Shell transversely short-oval, very oblique, with moderately-sized incurved beaks situated near the anterior end, and not projecting above the cardinal umbonal surface posterior to them. Hinge-line only moderately arcuate, and about parallel to the basal line, which is also only moderately curved. Anterior and posterior ends broadly rounded, the former somewhat more sharply so than the latter, owing to the excavation in front of the beaks. Surface of the valves as seen in casts only moderately convex, and marked by fine, even lines of growth parallel to the margin of the valve. Muscular imprints very faint. Pallial line too indistinct to be described with certainty, but the best evidence furnished would indicate that it was not very deep and rounded at the extremity. Hinge structure not determined.

This I suppose to be the shell which Mr. Conrad describes as *Caryatis Delawarensis* (Gabb's sp.) in the American Journal of Conchology, and of which he says he was fortunate enough to obtain the mold of a hinge, "which proves it to be a *Caryatis*." I have not been able to obtain specimens showing the hinge features, so shall accept his generic reference without question. He, in common with others, had identified this as *Cyprina Morrissi* Sowerby, an English Lower Eocene species. Mr. Gabb's *Dione Delawarensis* is, I think, a distinct species from this one, being of a more regularly oval form, with narrower anterior and posterior extremities, a larger and more prominent beak, which is placed much farther from the anterior end of the shell, and is more erect than that of this one. It also occurs in the Lower Marls of the Cretaceous system, and I have not seen a specimen from the Eocene beds which I should be willing to consider as the same with those.

Formation and locality.—In the light-colored clay layers known as the Stony Marls, at the top of the Upper Beds of Marls, characterized by Eocene fossils, at Shark River, Squankum, and near Farmingdale, New Jersey.

MACTRIDÆ.

Genus VELEDA Conrad. 1871.

(Am. Jour. Conch., Vol. VI, p. 74.)

Veleda equilatera, n. sp.

Plate XXX, Fig. 17.

Shell very small, transversely elliptical in outline, and nearly equilateral; length a little less than twice the height, and both extremities somewhat pointed or narrowly rounded; basal line broadly curved, and the cardinal line sloping from the beak nearly equally on each side, the margins forming an angle of about one hundred and thirty degrees. Beak small, but broad and compressed; disk of the valve depressed, convex, or almost flattened, as seen in casts. Hinge characters known only by the imprint of a linear tooth on each side of the beak, situated about half way between the beak and the posterior end of the shell, on the posterior side, and still further out proportionally on the anterior end. Muscular markings not seen. Surface of the shell, as indicated on the cast, marked by faint concentric lines of growth parallel to the margin.

This species differs from either of those described from the Lower Marls in its transverse and equilateral form. Its transverse or elliptical character at once distinguishes it from *V. lintea* Con., and its equilateral form from *V. tellinoides*, and the want of regular, even, concentric ridges on the disk of the shell, and small beak, from *V. transversa*. So far as it is yet known, it is a much smaller species than either of the last, but the examples known may be small individuals.

Formation and locality.—In the upper layers of the Upper Marls at Shark River, New Jersey.

CORBULIDÆ.

Genus CORBULA Brug.

Corbula (Neæra) nasutoides, n. sp.

Plate XXX, Figs. 18 and 19.

Shell of moderate size or larger, transversely ovate, inequivalve, anterior end longest and most inflated, and the left valve somewhat larger than the right. Valves both rather ventricose, the left inflated on the umbones. Beaks large, full, and strongly incurved, directed posteriorly in appearance; that of the left valve more incurved than the right one. Posterior end of the valves narrowed and rounded at the extremity, without posterior umbonal angle or truncation of the extremity. Surface of the valves marked only by concentric lines of growth.

The species, as known from casts retaining part of the external features, bears considerable resemblance to *C. nasuta* Conrad (=*C. Alabamiensis* Lea) from the Eocene sands of Claiborne, Ala., both in form, size, and surface markings, but differs in being less attenuated behind, is rather more equivalve, with more prominent beaks, and the striæ is somewhat finer. It is possible it may not be a *Corbula* or that it may be a smooth species of *Neæra*, but it resembles *Corbula* more closely. The absence of angulation along the posterior umbonal ridge, or of the corresponding truncation of the posterior end, is against it being a true *Corbula*.

Formation and locality.—In the upper layer of the Upper Marls, Shark River, and at Dr. Kneiskern's pits, New Jersey.

Genus NEÆRA Grey.

Neæra æquivalvis, n. sp.

Plate XXX, Figs. 20 and 21.

Shell large for the genus, with very convex or almost inflated valves, very nearly or quite of equal size, the apex of the beak only indicating any inequality. Outline strongly ovate, large in front with a sharply rounded anterior extremity and a slightly gibbous basal line; posterior end prolonged, narrow, and sharply rostrate. Beaks placed very far back, large and inflated on the umbones, directed posteriorly, incurved and minutely pointed at the apices, which are in close contact, or interlocking, that of the right valve being in advance of the other. Lunule obsolete, but the escutcheon area deeply impressed in the cast, representing a strongly inflected cardinal border in the shell. Hinge-teeth unknown; muscular scars and pallial line too faint to be observed in the cast. Surface of the shell marked by very distinct, but not strong, concentric undulations parallel to the margin of the valves. There are very faint indications of radiating lines on the cast. I do not think, however, that they indicate radii on the shell, but only represent vascular markings.

The cast has exactly the form externally of *Corbula Carolinensis* Conrad, as figured in the Appendix to the Report of the Geological Survey of North Carolina, W. C. Kerr, Vol. I, page 11, Pl. II, Fig. 15, and is almost of the same size. I cannot think, however, that it has any relations to that shell, for it certainly is not a cast of *Corbula*, and Mr. Conrad could never have considered such a form as a *Corbula* when examining the shell itself.

He also describes his shell as inequivalve, while this one is not perceptibly inequivalve, except for the overlapping of the beaks, which is so slight, and only at the extreme point, that there is really no difference in size. The posterior prolongation, moreover, is equally large on each valve, which it would not be in *Corbula*. Most of the species of *Neæra* are radiatingly ribbed, but there are species known which are smooth, such as *N. hyalina* Hinds; figured in Chenu's Manuel Conch. et de Pal. Conch., Vol. II, p. 50, Fig. 210. Mr. Conrad's species is from the Cretaceous, while this is from the beds referred to the Eocene. Mr. Meek figures a somewhat similar species, *N. ventricosa*, from the Fox Hills group of Dakota, in the Report of the U. S. Geological Survey of the Territories (Hayden), Vol. IX; Report on Invertebrate Fossils (Meek), Pl. XXX, Fig. 3, but in that one the beaks are erect, while these have a strong backward direction when taken in a lateral view of the shell.

Formation and locality.—In the upper layers of the Upper Marls at Shark River, New Jersey. In the collection of the American Museum of Natural History, New York City. (Eocene.)

PHOLADIDÆ.

Genus PARAPHOLAS Conrad. 1848.

(Proc. A. N. Sci., Phil., 1848, p. 121.)

Parapholas Kneiskerni, n. sp.

Plate XXX, Figs. 22–24.

An internal cast of both valves in conjunction represents a shell of an elongate-ovate or elongate-pyriform shape, measuring seven-eighths of an inch in length by half an inch in diameter at the larger end; is all that represents this species among the collections from the State. The anterior end is globose to the oblique mesial division, behind which it is rapidly narrowed to less than one-fourth of an inch at the posterior extremity, which appears to have been widely gaping. The mesial constriction is deep and very oblique, reaching the basal margin somewhat behind the middle of the entire length. Posterior area of the valves concentrically marked; anterior section of the valve triangular and rather small, with faint indications of a few radii; antero-basal pads large and broad, extending on the sides of the anterior end to the point of greatest diameter, and also extending backward beyond the mesial sulcus in considerable breadth, apparently reaching nearly or quite to the posterior extremity of the valves Anterior dorsal plates combined apparently of only medium size, quadrangular or lozenge-shaped, and pointed at either extremity, placed with their longest diameters in the direction of the junction of the valves. No posterior dorsal plates appear to have existed. Posterior dorsal slope concave, leaving the hinge-line sharply elevated.

The specimen being entirely an internal cast the surface characters of the shell can only be approximately determined. As no other species, so far as I can ascertain, is known from this formation in America, I can draw no comparison.

Formation and locality.—In the upper layers of the Upper Green Marls at Shark River, New Jersey. Collected by Dr. Kneiskern. Collection at Rutgers College.

TERIDIDÆ.

Genus TEREDO Linn.

Teredo emacerata, n. sp.

Plate XXX, Fig. 25.

The species is known only by the casts of tubes, which are slender and not known to exceed two inches in length. They are closely crowded in the only examples observed, and have been found in burrows in wood. Their direction is much contorted, and although often nearly three-sixteenths of an inch in diameter at the lower extremity, they rapidly taper to within one-half of that size, and are very slender for the greater part of their length. The lower extremity is rounded, and in some cases bulbous. The species differs from *T. tibialis* Mort. of the middle beds, in having burrowed in wood instead of in sand, and in being much smaller, much more tortuous, and more densely crowded than is usual with that species, besides having no appearance of having formed a shelly lining.

Formation and locality.—In the upper layer of the Upper Marl, at Shark River, New Jersey.

SECTION VII.

UNIONIDÆ FROM THE CLAYS AT FISH HOUSE, CAMDEN COUNTY.

The species of Unionoid shells described below occur in bluish-black and dove-colored clays a few miles above Camden, N. J., and are probably from near the base of the Cretaceous series of the State. The latest evidence obtained places them as probably equivalent to the Lignite clays near the top of the Plastic Clay series, and below the Lower Marls. This makes them the oldest molluscan Mesozoic fossils of the State, except those from the Woodbridge and Raritan Clays described in Section II. The shells appear to have been first discovered by Professor Cope, of Philadelphia, and were by him called to the attention of Mr. Isaac Lea, who described ten of the twelve now known species. Subsequently others collected numbers of them. Prof. J. Carvill Lewis, of Germantown, Pa., has a large collection, the best of which he very kindly loaned me for use in the following descriptions, and he also has placed me under obligations by the trouble he took to obtain for me the use of Mr. Lea's type specimens from the collection of the Academy of Natural Sciences of Philadelphia. Dr. L. N. Britton has also collected a large number for the State survey, from which some of the figured examples were obtained.

In regard to the geological position of these shells I shall offer no opinion, not having visited the beds myself. Professor Cope appeared to consider them as occurring in beds actually below the lowest of the Green Marls, and others with whom I have conversed hold the same opinion, while still others consider them as of much later date. Dr. White in "A Review of the Non-marine Fossil Mollusca of North America," Third annual report U. S. Geol. Survey, 1883, says they are "almost certainly of post-Tertiary date." So far as the shells themselves afford evidence this might be said to be very likely; still they do not afford any positive information on the subject. They present certain differences, observable even in their very imperfect condition, when compared with their living representatives, which are certainly as great as differences between many of the western Cretaceous Unionidæ and the living representatives of the same species; and I am not at all prepared to say that any one of the twelve species named, if it could be obtained in condition perfect enough for complete comparison, would not prove quite distinct from the one whose name it bears. I have made comparisons with these living forms, some of which are noted under the descriptions of the species.

The condition of preservation of these shells is a great drawback to their satisfactory study. Their remains consist mostly of internal casts, much distorted, with a portion of the epidermis usually preserved, and occasionally a small amount of the calcareous material. The cavities left by the decomposition of the teeth are sometimes quite characteristic, but more frequently compressed and distorted so as to be of but little service in comparison. The valves have usually been preserved in contact, so that the hinge features do not show on the cast, although the muscular imprints, and often the pallial line, are very handsomely preserved. But the amount of compression which the specimens have undergone can only be judged of by the form of examples which have been imbedded vertically or obliquely in the clays. This has often been so great as to place them entirely beyond the possibility of determination. Owing to the differences of form and the difficulty of accurate comparison with living forms, I have preferred to leave them standing as distinct species, under the names originally used by Mr. Lea, and have added two others from the collection of Professor Lewis, following the same system of nomenclature.

UNIONIDÆ.

Genus UNIO Retzius.

Unio nasutoides.

Plate XXXIV, Figs. 4 and 5.

Unio nasutoides **Lea. Proc. A. N. Sci., Phil., 1868, p. 163. Pamphlet, 1868, p. 30.**

Shell very transverse, about twice and a half as long as high, rounding from below anteriorly and pointed behind, with the beaks within the anterior third of the length. Surface of shell smooth, valves compressed and subangular along the umbonal ridge. Muscular scars strong on the anterior end, and rather faintly marked on the posterior sides; lateral teeth strong, of great length, and nearly or quite straight, cardinal teeth proportionately small and strongly striated.

Mr. Lea remarks of this species that it "is very nearly the same in outline with the well-known *nasutus* Say, but is more acute at the posterior margin, in which character it is more nearly allied to *Fisherianus*." There is certainly a very close resemblance between these fossil forms and the ordinary forms of *U. nasutus*, as they occur in the Hudson River and its confluents, especially those from the Mohawk and those from the Erie Canal in its eastern parts. Some of the shells which I have seen of this species preserve the form very perfectly, though much of the shell substance has been removed, especially along the hinge. The lateral teeth appear to have been very strong, and the cardinal ones are longitudinally striate more strongly than any I remember to have seen in *U. nasutus;* but the shells have been considerably thickened, as is evidenced by the strong anterior muscular scars. The epidermis has also been strongly ridged. Among the specimens loaned me by Prof. H. C. Lewis I find one specimen which is more broadly truncate posteriorly and would seem to have had a much greater thickness, especially behind the middle of the valve. This one I have been somewhat inclined to place under *U. prœanodontoides* described for the first time, but it lacks the cylindrical form, although partially possessing the oblique median sulcus of that one.

Unio radiatoides.

Plate XXXIV, Figs. 1–3.

Unio radiatoides Lea. Proc. A. N. Sci., Phil., 1868, p. 163. Pamphlet by I. Lea, p. 30.

Shell of moderate size, transversely broad-oval in outline with compressed or gently convex valves, generally a little narrower at the anterior than at the posterior end; the hinge-line gently arcuate and slightly rising posteriorly. Shell surface marked by concentric lines of growth. Anterior muscular scar large, round; posterior scar faint. Cardinal teeth comparatively small; lateral moderately strong and but slightly curved. The shells which I have identified with the above name are somewhat broader or higher than the generality of specimens of *U. radiatus* as they occur in the Hudson River and its tributaries; and the cardinal teeth are smaller or more compressed. In other respects they correspond very closely in all general particulars. There is very great difficulty in distinguishing between this and *U. cariosoides*. In fact I cannot say that I am at all sure I have done so. Between their living representatives, if we take casts of the interiors and throw out the additional convexity of *U. cariosus*, it would be very difficult to say wherein they differ, and among these fossil specimens there is not an individual but that is more or less distorted as well as otherwise imperfect.

Unio subrotundoides.

Plate XXXII, Fig. 5.

Unio subrotundoides La. Proc. A. N. Sci., Phil., 1868, p. 163. Pamphlet by Lea, p. 30.

Of this species I have not been able to identify any individual among the collections which I have examined and have therefore figured the type specimen used in the original description, as labeled in the collection at Philadelphia. The specimen is very broad ovate in outline, being longer than high; the greatest height being considerably behind the beaks but nearly midway of the length of the shell. Valves depressed convex with strong concentric striæ; hinge-line strongly arcuate and the beaks appressed; anterior end of shell short. Cardinal teeth? Lateral teeth long, thin, and strongly arched.

Mr. Lea states in his description of this shell that the cardinal teeth are "apparently small." The space for the cardinal tooth in the specimen is filled with foreign matter, but I think it would prove to be of considerable dimensions if cleaned out. The form of the shell differs more from *U. subrotundus* Lea, as figured by that author in his "Land and Fresh Water Shells," Vol. IV, Pl. 18, Fig. 45, than any other species of this group of fossils differs from the one after which it was named. In fact it differs so much that if left entirely to my own judgment I should not have thought of referring it to that species at all. The measurements as given with Mr.

Lea's description (length 2.6, breadth 3.4 inches) are evidently transposed from what he intended, the length being nearly three and a half and the height two and six-tenths inches, as will readily be seen by reference to the figure given, which is of his type specimen.

Unio cariosoides.

Plate XXXII, Fig. 3.

Unio cariosoides **Lea. Proc. A. N. Sci., Phil., 1868, p. 163. Pamphlet by Lea, p. 31.**

"Shell smooth, broadly elliptical, somewhat inflated, obtusely angular behind, rounded before; beaks somewhat raised, removed from medial; cardinal teeth ——; lateral teeth long and slightly curved. Length 2.5, breadth 4.8 inches." (Lea.)

Mr. Lea's type specimen is the only one of this species which I have seen. As he observes in his remarks following the above description, it rather closely resembles the elongated males of *U. cariosus.* The specimen has apparently been imbedded in the clay vertically and has been slightly compressed in that direction, making it a little less broad between the cardinal and basal margins than it originally was, and giving greater angularity to each of the extremities, and at the same time greater rotundity to the valves. If this had not been the case the shell would present much the same proportions as those which I have referred to *U. radiatoides*, although it may never have been quite as high in proportion to its length. The specimen is mostly an internal cast, but retains a small portion of the epidermal layer, as do most of the specimens. The impressions of the lateral teeth are slender, rather long and arcuate. What remains of the borders of the cavity of the cardinal teeth would indicate that the principal one had been large and thick, but there is very little of it left to judge from. The anterior muscular impression is large, and situated well forward. The posterior scar is not visible. The pallial line on the anterior half is well marked. In the measurements as given by Dr. Lea the "length" refers to the distance from the cardinal line to the basal margin, and the "breadth" from anterior to posterior extremity. The locality for this and *U. subrotundoides*, as given on the labels accompanying them, is 6 miles north of Camden, New Jersey.

Unio humerosoides.

Plate XXXI, Fig. 4.

Unio humerosoides Lea. Proc. A. N. Sci. Phil., 1868, p. 163. Pamphlet by Lea, p. 131.

"Shell smooth, ovately oblong, very much compressed, rounded behind and before; beaks slightly raised, removed from medial; cardinal teeth large and compressed; lateral teeth rather long and slightly curved. Length 2.6, breadth 4.2 inches." (Lea.)

The shell marked as the type of this species in Mr. Lea's collection in the Academy is of a broad oval form, being longer than high, as indicated by his measurements. It resembles so closely those referred to *U. radiatoides* as to be not easily distinguished in the imperfect condition in which they are found. On close examination it will be seen not to round forward so rapidly on the posterio-cardinal border as does that species, and to be somewhat proportionally broader from the base to the cardinal line. The surface of the type specimen shows evidence of having been rather coarsely marked with concentric undulations on the posterior part. The specimen figured is Lea's type.

Unio Roanokoides.

Plate XXXIII, Figs. 1 and 2, and Plate XXXIV, Fig. 7.

Unio Roanokoides Lea. Proc. A. N. Sci., Phil., 1868, p. 164. Pamphlet by Lea, p. 31.

Shell transverse, subquadrangular, nearly twice as long as high; arcuate on the hinge-line in the cast, and broadly rounded on the base. Anterior end rather sharply rounded; posterior end truncate and a very little oblique; longest below. Beaks situated at about the anterior third of the length. Valves compressed, more particularly so on the anterior side of the beaks. The teeth have been strong; the cardinals wide but not strongly elevated; the laterals long, slightly curved, and quite thickened in some cases toward the outward end. Muscular scars large, well marked, and circular.

This species closely resembles *U. humerosoides* in its general outlines, but is somewhat longer from anterior to posterior, and the latter extremity is possibly a little more strongly truncate. The separation is, however, merely arbitrary. Among older forms of fossil shells I should not think of separating them as species. Mr. Lea remarks of this species that its form is very unusual, and that it is allied to *U. Roanokoensis* and *U. macer* Lea; also, that it is remarkably compressed at the anterior end for a Unio, but that the same character applies to others from the same locality.

Unio ligamentinoides.

Plate XXXII, Fig. 4, and Plate XXXIV, Fig. 8.

Unio ligamentinoides Lea. Proc. A. N. Sci., Phil., 1868, p. 164. Pamphlet by Lea, p. 31.

Shell longitudinally ovate and somewhat regular in outline; rather broader behind than in front. Hinge-line rather strongly arcuate, more strongly bent just in front of the beaks, which are situated nearly at the anterior third of the length of the shell. Basal margin strongly and regularly curved. Valves compressed. Lateral teeth comparatively slender and curved; cardinal tooth large and only moderately thick. Anterior muscular scar comparatively large, moderately deep. Posterior scar very faintly marked.

The shell has very much the outline of the male of *U. ligamentinus* Lea, and is readily distinguished from specimens of *U. radiatoides* by its rounder form. The type specimen of Dr. Lea is more pointed posteriorly than others which I have seen, and the valves rather more compressed. Besides, it has some appearance of a slight alation at the posterior extremity of the cardinal line, and might readily be taken for a vertically compressed individual of *U. alatoides*. The epidermis is also less rugose than in some of the others.

Unio alatoides.

Plate XXXIII, Figs. 3 and 4, and Plate XXXIV, Fig. 6.

Unio alatoides Lea. Proc. A. N. Sci., Phil., 1868, p. 164. Pamphlet by Lea, p. 32.

Shell compressed, broadly ovate, very much wider posteriorly than in front, the posterior alation giving a broader form and a more direct upward tendency to the lines of growth, even when the alation itself is not preserved. Umbones very much compressed and the beaks hardly perceptibly elevated. The teeth are not visible in either of the two specimens before me nor are the muscular scars sufficiently well marked to warrant a description of their characters, though the anterior scar appears to have been tolerably large and well marked. The surface of the shell has been marked by rather strong concentric wrinkles for one of this usually smooth type.

Mr. Lea mentions in his original description of this species that the cardinal teeth are "oblique and compressed, lateral teeth long, large, lamellar, and very slightly curved."

Unio præanodontoides, n. sp.

Plate XXXI, Fig. 2.

Shell cylindrical, a little less than three times as long as high, and about four-fifths as thick through the closed valves as the height from the hinge-line to the base of the shell. Hinge-line rather straight and long, beaks small and inconspicuous, situated a little less than one-third of the entire length of the shell from the anterior end. Anterior end narrowly rounded; posterior end long and nasute; the point of greatest length almost on a line of the center of the valve. Body of the shell marked just forward of the middle by a broad shallow mesial depression passing from the beaks to the base of the shell Anterior teeth moderately strong; lateral tooth long and slender, but strongest near the posterior end. Muscular scars faintly marked.

The shell is remarkably similar to the narrowly cylindrical forms of *U. anodontoides* Lea. It is perhaps not quite so high from base to hinge, but in other respects is exceedingly like it. The posterior end is also perhaps slightly narrower, and in this respect resembles in form *U. nasutus;* but the valves are much more ventricose, have not that angularity of the posterior umbonal slope, and differ essentially in the shallow sulcus crossing the valves. The specimen used retains both valves, but spread widely open. It is the property of Prof. Henry Carville Lewis, of Philadelphia, who kindly loaned it to me with other specimens of the various species here described.

Unio rectoides, n. sp.

Plate XXXII, Figs. 1 and 2.

Shell very elongate with subparallel basal and cardinal margins, the former very slightly sinuate near the middle of the length; anterior extremely narrow approaching pointed and longest above the middle of the height; posterior end broader and obtusely rounded and longest below. Valves compressed, more convex behind than in front where they have been quite attenuate; anterior muscular scar quite moderate in size, but well marked; posterior scar faint. Cardinal teeth strong, apparently double. Lateral teeth apparently straight and moderately strong. Surface of the shell not observed.

This species presents strongly the features of *U. rectus*, from the Ohio watershed, but perhaps even more strongly those of the species from the waters of Georgia and Alabama. It is so very distinct in its elongate narrow form from any of those associated with it that it cannot well be mistaken.

Genus ANODONTA Cuvier.

Anodonta grandoides.

Plate XXXV, Figs. 2 and 3.

Anodonta grandoides Lea. Proc. A. N. S., Phil., 1868, p. 164. Pamphlet, 1868, p. 32.

Mr. Lea's description of this species reads as follows: "Shell smooth, elliptical, very much inflated, ventricose, obtusely angular behind, obliquely rounded before; beaks submedial, flattened on the tips, but very much inflated on the umbos."

The shells of this species in the collection under consideration are much better preserved than those of *A. corpulentoides*, probably because they were somewhat stronger, and perhaps also because from their somewhat greater length they were less liable to become imbedded obliquely in the sediment, and thus escaped the oblique pressure to which many of the others were subjected. Their form appears to have been less inflated than *A. corpulentoides*, with the beaks less central, the posterior end being longer proportionally, as well as much more pointed, and more angular along the posterior umbonal ridge, while the proportional height of the shell is considerably less. One of the specimens on which these observations are based retains nearly its original form, being only slightly compressed and having much of the epidermal layer preserved. There are several other shells among our freshwater forms that bear considerable resemblance to this one, as well as *A.*

grandis Say. One form which I have under the name *A. plana* from rivers in Western New York presents a remarkable resemblance to it, both in size and outline.

Anodonta corpulentoides.

Plate XXXV, Fig. 1.

Anodonta corpulentoides Lea. Proc. A. N. S., Phil., 1868, p. 164. Pamph., 1868, p. 32.

The following is Mr. Lea's description of this shell: "Shell smooth, rotundo-elliptical, exceedingly inflated, very ventricose, obtusely angular behind, rounded before; beaks submedial, flattened at the tips, but excessively inflated on the umbos." In his remarks on the species he says it is so nearly like *A. corpulenta* Cooper that he has no hesitation in considering that as its nearest representative. The specimens which I have seen are all more or less crushed and distorted, but they preserve both valves and retain much of the original shell, but little of the epidermal layer. So far as can be judged of the original form of the specimens from the most perfect ones, I should think the anterior portion in front of the umbos might have been somewhat longer, with the extremity of the hinge-line a little more rounded than specimens of *A. corpulenta* which I have received from Illinois. In other respects I can detect no difference whatever. The muscular scars are not discernible on any of the specimens.

SECTION VIII—APPENDIX.

CLASSIFIED LIST OF THE SPECIES DESCRIBED IN THIS VOLUME.

In this list the species from the Lower Marl Beds are indicated by the letter *L;* those from the Middle Marl Beds by *M;* those from the base of the Upper Marls, which bed is included in the Cretaceous, by the letter *U;* and those from the top layer, supposed to be Eocene, by the letter *E.* *P. C.* indicates the Plastic Clays at the base of the Cretaceous or older, and *U. C.* the clays near Fish House, 4 miles above Camden, New Jersey, which contain the Unios.

Class BRACHIOPODA.

Family TEREBRATULIDÆ.

Genus TEREBRATULA.		
T.	Harlani *Morton*	*L.*
T.	Harlani, var. fragilis *Morton*	*L.*
Genus TEREBRATULINA.		
T.	Atlantica *Morton*	*U.*
T.	florida *Morton*	*?*
T.	lachryma *Morton*	*E.*
Genus TEREBRATELLA.		
T.	plicata *Say*	*L.*
T.	Vanuxemi *Lyell* and *Forbes*	*L.*

Class LAMELLIBRANCHIATA.

Order ASIPHONIDA.

Suborder MONOMYARIA.

Family OSTREIDÆ.

- Genus OSTREA *Linnæus.*
  - O. denticulifera *Conrad* .... *L.*
  - O. crenulimarginata *Gabb* .... *L.*
  - O. glauconoides *Whitfield* .... *E.*
  - O. glandiformis *Whitfield* .... *U.*
  - O. larva *Lamarck* .... *L.*
  - O. (Alectrionia) linguafelis *Whitfield* .... *E.*
  - O. panda *Morton* .... *E.*
  - O. plumosa *Morton* .... *L.*
  - O. subspatula *Lyell* and *Forbes* .... *L.*
  - O. tecticosta *Gabb* .... *L.*
- Genus GRYPHÆA.
  - G. Bryani *Gabb* .... *U.*
  - G. Bryani, var. precedens *Whitfield* .... *M.*
  - G. convexa *Morton* .... *L.*
  - G. mutabilis *Morton* .... *L.*
  - G. vesicularis *Lamarck* .... *L. M., E*
  - G. var. navia *Roemer* .... *L. M.*
- Genus GRYPHÆOSTREA.
  - G. vomer *Morton* .... *M.*
- Genus EXOGYRA.
  - E. costata *Say* .... *L.*

Family ANOMIIDÆ.

- Genus ANOMIA .... *L.*
  - A. argentaria *Morton* .... *L.*
  - A. tellinoides *Morton* .... *L.*
- Genus DIPLOSCHIZA.
  - D. cretacea *Conrad* .... *L*
- Genus PARANOMIA.
  - P. lineata *Conrad* .... *L.*
  - P. scabra *Morton* .... *L.*

Family PECTENIDÆ.

Genus Pecten *Klein.*

P. Kneiskerni *Conrad* .... *E.*
P. planocostatus *Whitfield* .... *L.*
P. quinquenarius *Conrad* .... *L.*
P. Rigbyi *Whitfield* .... *E.*
P. tenuitestus *Gabb* .... *L.*
P. venustus *Morton* .... *L.*
P. (Chlamys) craticulus *Morton* .... *L.*
P. (Syncyclonema) perlamellosus *Whitfield* .... *L.*

Genus Amusium.

A. simplicum *Conrad* .... *L.*
A. Conradi *Whitfield* .... *L.*

Genus Camptonectes.

C. (Amusium) Burlingtonensis *Gabb* .... *L.*
C. parvus *Whitfield* .... *L.*

Genus Neithea *Drouet* .... *L.*

N. quinquecostata *Sowerby* .... *L.*

Family SPONDYLIDÆ.

Genus Spondylus *Lamarck.*

S. gregalis *Morton* .... *L.*

Genus Dianchora *Sowerby.*

D. echinata *Morton* .... *L.*

Genus Plicatula *Lamarck.*

P. urticosa *Morton* .... *L.*

Genus Radula *Klein.*

R. acutilineata *Conrad* .... *L.*
R. pelagica *Morton* .... *L.*
R. reticulata *Lyell* and *Forbes* .... *L.*

Suborder HETEROMYARIA.

Family MYTILIDÆ.

Genus Mytilus *Linnæus.*

M. oblivius *Whitfield* .... *L.*

Genus Modiola *Lamarck.*

M. Burlingtonensis *Whitfield* .... *L.*

- Family MYTILIDÆ—Continued.
  - Genus Modiola—Continued.
    - M. (Lithodomus?) inflata *Whitfield* .... *M.*
    - M. Johnsoni *Whitfield* .... *U.*
    - M. Julia *Lea* .... *L.*
    - M. ovata *Gabb* .... *M.*
  - Genus Lithodomus *Cuvier.*
    - L. affinis *Gabb* .... *L.*
    - L. Ripleyana *Gabb* .... *L.*
- Family PTERIIDÆ *Meek.*
  - Genus Pteria Scopoli.
    - P. *annosa* = *Avicula annosa* Conrad .... *E.*
    - P. laripes *Morton* .... *L.*
    - P. navicula *Whitfield* .... *L.*
    - P. petrosa *Conrad* .... *L.*
  - Genus Meleagrinella *Whitfield.*
    - M. abrupta, *Conrad's* sp .... *L.*
  - Genus Gervilliopsis *Whitfield.*
    - G. ensiformis *Conrad* .... *L.*
    - G. minima *Whitfield* .... *L.*
  - Genus Inoceramus *Sowerby.*
    - I. Barabini *Morton* .... *L.*
    - I. perovalis *Conrad* .... *L.*
    - I. pro-obliqua *Whitfield* .... *L.*
    - I. quadrans *Whitfield* .... *L.*
    - I. Sagensis *Owen* .... *L.*
    - I. Sagensis, var. quadrans *Whitfield* .... *L.*
- Family PINNIDÆ.
  - Genus Pinna *Linnæus.*
    - P. laqueata *Conrad* .... *L.*
    - P. rostriformis *Morton* .... *M.*

Suborder DIMYARIA.

- Family ARCIDÆ.
  - Genus Arca *Linnæus*
    - A. altirostris *Gabb* .... *L.*
    - A. quindecimradiata *Gabb* .... *U.*

Family ARCIDÆ—Continued.
Genus Nemoarca *Conrad.*
N. cretacea *Conrad* .... *L.*
Genus Nemodon *Conrad.*
N. angulatum *Gabb* .... *L.*
N. brevifrons *Conrad* .... *L.*
N. Eufaulensis *Gabb* .... *L.*
Genus Breviarca *Conrad.*
B. Saffordi *Gabb* .... *L.*
Genus Trigonarca.
T. cuneiformis *Conrad* .... *L.*
T. transversa *Gabb* .... *L.*
Genus Cibota *Browne.*
C. multiradiata *Gabb* .... *L.*
C. obesa *Whitfield* .... *L.*
C. rostellata *Morton* .... *L.*
C. uniopsis *Conrad* .... *L.*
Genus Idonearca *Conrad.*
I. antrosa *Morton* .... *L.*
I. compressirostra *Whitfield* .... *M.*
I. medians *Whitfield* .... *M.*
I. Tippana *Conrad* .... *L.*
I. vulgaris *Morton* .... *L.*
Genus Axinea *Poli.*
A. alta *Whitfield* .... *L.*
A. Conradi *Whitfield* .... *E.*
A. Mortoni *Conrad* .... *L.*

Family NUCULIDÆ.
Genus Nucula *Lamarck.*
N. Circe *Whitfield* .... *E.*
N. Monmouthensis *Whitfield* .... *L.*
N. percrassa *Conrad* .... *L.*
N. perequalis *Conrad* .... *L.*
N. Slackiana Gabb .... *L.*

Family NUCULIDÆ—Continued.
- Genus Nuculana *Link.*
  - N. albaria *Conrad* .... *E.*
  - N. compressifrons *Conrad* .... *L.*
  - N. Gabbana *Whitfield* .... *L.*
  - N. longifrons *Conrad* .... *L*
  - N. pinniformis *Gabb* .... *L.*
  - N. protexta *Gabb* .... *L.*
- Genus Perrisonota *Conrad*
  - P. protexta *Conrad* .... *L.*
- Genus Nucularia *Conrad.*
  - N. papyria *Conrad* .... *L.*
  - N. secunda *Whitfield* .... *E.*

Family TRIGONIDÆ.
- Genus Trigonia *Brug.*
  - T. cerulea *Whitfield* .... *L.*
  - T. Eufaulensis *Gabb* .... *L.*
  - T. Mortoni *Whitfield* .... *L.*

Family UNIONIDÆ.
- Genus Unio *Ritzius.*
  - U. alatoides *Lea* .... *U. C.*
  - U. cariosoides *Lea* .... *U. C.*
  - U. humerosoides *Lea* .... *U. C.*
  - U. ligamentinoides *Lea* .... *U. C.*
  - U. nasutoides *Lea* .... *U. C.*
  - U. præanodontoides *Whitfield* .... *U. C.*
  - U. radiatoides *Lea* .... *U. C.*
  - U. rectoides *Whitfield* .... *U. C.*
  - U. Roanokoides *Lea* .... *U. C.*
  - U. subrotundoides *Lea* .... *U. C.*
- Genus Anodonta *Cuvier.*
  - A. corpulentoides *Lea* .... *U. C.*
  - A. grandoides *Lea* .... *U. C.*

Order SIPHONIDA.

Suborder INTEGRIPALLIATA.

Family ASTARTIDÆ.

Genus Astarte *Sowerby.*

- A. castanella *Whitfield* .... *E.*
- A. planimarginata *Whitfield* .... *E.*
- A. veta *Conrad* .... *P. C.*

Genus Cardita *Brug.*

- C. Brittoni *Whitfield* .... *E.*
- C. intermedians *Whitfield* .... *U.*
- C. perantiqua *Conrad* .... *E.*

Family CRASSATELLIDÆ

Genus Crassatella *Lamarck*

- C. alta *Conrad* .... *E.*
- C. cuneata *Gabb* .... *L.*
- C. curta *Conrad* .... *U.*
- C. Delawarensis *Gabb* .... *U.*
- C. littoralis *Conrad* .... *U.*
- C. Monmouthensis *Gabb* .... *L.*
- C. obliquata *Whitfield* .... *E.*
- C. prora *Conrad* .... *L.*
- C. rhombea *Whitfield* .... *U.*
- C. subplana *Conrad* .... *L.*
- C. transversa *Gabb* .... *L.*
- C. vadosa *Morton* .... *L.*

Genus Scambula *Conrad.*

- S. perplana *Conrad* .... *L.*

Genus Gouldia *Adams.*

- G. Conradi *Whitfield* .... *L.*
- G. decemnaria *Conrad* .... *L.*
- G. declivis *Conrad* .... *L.*
- G. paralis *Conrad* .... *L.*

Genus Vetocardia *Conrad.*

- V. crenulirata, *Lea's* sp. .... *L.*
- V. octolirata *Gabb* .... *L.*

- Family LUCINIDÆ.
  - Genus Lucinia *Brug.*
    - L. cretacea *Conrad* .... *L.*
    - L. Smockana *Whitfield* .... *L.*
- Family CHAMIDÆ.
  - Genus Diceras *Lamarck.*
    - D. dactyloides *Whitfield* .... *L.*
- Family CARDIIDÆ.
  - Genus Cardium *Linnæus.*
    - C. Eufaulensis *Conrad* .... *L.*
    - C. Ripleyanum *Conrad* .... *L.*
    - C. Ripleyense *Conrad* .... *L?*
    - C. (Criocardium) dumosum *Conrad* .... *L.*
    - C. (C.) multiradiatum *Gabb* .... *L.*
    - C. (C.) nucleolus *Whitfield* .... *U.*
  - Genus Pachycardium *Conrad.*
    - P. Burlingtonense *Whitfield* .... *L.*
  - Genus Protocardium *Beyr.*
    - P. curtum *Conrad* .... *E.*
    - P. perelongatum *Whitfield* .... *L.*
  - Genus Fulvia *Gray.*
    - F. tenuis *Whitfield* .... *L.*
  - Genus Fragum *Bolton.*
    - F. tenuistriatum *Whitfield* .... *L.*
  - Genus Leiopistha *Meek.*
    - L. elegantula *Roemer* .... *L.*
    - L. inflata *Whitfield* .... *L.*
    - L. protexta *Conrad* .... *L.*
  - Genus Cymella *Meek.*
    - C. Meeki *Whitfield* .... *L.*
- Family CYPRINIDÆ.
  - Genus Veniella *Stoliczka.*
    - V. Conradi *Morton* .... *L.*
    - V. decisa *Morton* .... *L.*
    - V. elevata *Conrad* .... *L.*

Family CYPRINIDÆ—Continued.

Genus VENIELLA—Continued.

V.	inflata *Conrad*	*L.*
V.	rhomboidea *Conrad*	*U.*
V.	subovalis *Conrad*	*L.*
V.	trapezoidea *Conrad*	*L.*
V.	trigona *Gabb*	*L.*

Genus AMBONICARDIUM *Whitfield.*

A.	Cooki *Whitfield*	*P. C.*

Genus ISOCARDIA *Lamarck.*

I.	Conradi *Gabb*	*M.*

Genus SPHÆRIOLA *Stoliczka.*

S.	umbonata *Whitfield*	*L.*

Family CYRENIDÆ.

Genus CORBICULA *Muhlfeld.*

C.	annosa *Conrad*	*P. C.*
C.	emacerata *Whitfield*	*P. C.*

Suborder SINUOPALLIATA.

Family VENERIDÆ.

Genus CALLISTA *Poli.*

C.	Delawarensis *Gabb*	*L.*

Genus CARYATIS *Roemer.*

C.	ovalis *Whitfield*	*E.*
C.?	veta *Whitfield*	*U.*

Genus APHRODINA *Conrad.*

A.	Tippana *Conrad*	*L.*

Genus CYPRIMERIA *Conrad.*

C.	excavata *Morton*	*L.*
C.	densata *Conrad*	*L.*
C.	depressa *Conrad*	*L.*
C.	Heilprini *Whitfield*	*L.*
C.	spissa *Conrad*	*L.*

Genus DOSINIA *Scopoli.*

D ?	erecta *Whitfield*	*L.*
D.	Gabbi *Whitfield*	*L.*

Family VENERIDÆ—Continued.
Genus TENEA *Conrad.*
T. pinguis *Conrad* .... *L.*
Family PETRICOLIDÆ.
Genus PETRICOLA *Lamarck.*
P. Nova-Ægyptica *Whitfield* .... *U.*
Family TELLINIDÆ.
Genus TELLIMERA *Conrad.*
T. eborea .... *L.*
Genus LINEARIA *Conrad*
L. contracta *Whitfield* .... *L.*
L. metastriata *Conrad* .... *L.*
Genus ÆORA *Conrad.*
A. cretacea *Conrad* .... *L.*
Genus ÆNONA *Conrad.*
A. Eufaulensis *Conrad* .... *L.*
A. papyria *Conrad* .... *L.*
Genus CORIMYA *Agassiz.*
C. tenuis *Whitfield* .... *L.*
Family DONACINIDÆ.
Genus DONAX *Linnæus.*
D. Fordi *Lea* .... *L.*
Family MACTRIDÆ.
Genus VELEDA *Conrad.*
V. æquilatera *Whitfield.*
V. lintea *Conrad* .... *L.*
V. nasuta *Whitfield* .... *U.*
V. tellinoides *Whitfield* .... *L.*
V. transversa *Whitfield* .... *L.*
Genus GNATHODON *Rang.*
G. tenuidens *Whitfield* .... *P. C.*
Family ANATINIDÆ.
Genus PHOLADOMYA *Sowerby.*
P. occidentalis *Morton* .... *L.*
P. Roemeri *Whitfield* .... *L.*

- Family ANATINIDÆ—Continued.
  - Genus PERIPLOMYA *Conrad.*
    - P. elliptica *Conrad* .... L.
    - P. truncata *Whitfield* .... U.
  - Genus CERCOMYA *Agassiz.*
    - C. peculiaris *Conrad* .... L.
- Family CORBULIDÆ.
  - Genus CORBULA *Brug.*
    - C. crassiplica *Gabb* .... L.
    - C. Foulki *Lea* .... L.
    - C. subcompressa *Gabb* L
    - C. (NEÆRA) nasutoides *Whitfield* .... E.
  - Genus NEÆRA *Gray.*
    - N. æquivalvis *Whitfield* .... E.
- Family SAXICAVIDÆ.
  - Genus PANOPEA *Menard.*
    - P. elliptica *Whitfield* .... U.
    - P. decisa *Conrad* .... L.
- Family SOLENIDÆ.
  - Genus SOLYMA *Conrad.*
    - S. lineolata *Conrad* .... L.
  - Genus LEPTOSOLEN *Conrad.*
    - L. biplicata *Conrad* .... L.
  - Genus LEGUMEN *Conrad.*
    - L. appressum *Conrad* .... L.
    - L. planulatum *Conrad* .... L.
  - Genus SILIQUA *Muhlfeld.*
    - S. cretacea *Gabb* .... L.
- Family PHOLADIDÆ.
  - Genus PHOLAS *Linnæus.*
    - P. cithara *Morton* .... L.
    - P.? lata *Whitfield* .... L.
  - Genus MARTESIA *Leach.*
    - M. (PHOLAS) cretacea *Gabb* L
  - Genus PARAPHOLAS *Conrad.*
    - P. Kneiskerni *Whitfield* .... E.

Family TEREDIDÆ.

Genus TEREDO *Linnœus.*

T. emacerata *Whitfield* .... *E.*
T. irregularis *Gabb* .... *L.*
T. tibialis *Morton* .... *M.*

Family GASTROCHÆNIDÆ.

Genus GASTROCHÆNA *Spengler.*

G. Americana *Gabb* .... *M.*

Genus CLAVAGELLA *Lamarck.*

C. armata *Morton* .... *L.*

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PLATE I.

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TEREBRATELLA VANUXEMI Lyell and Forbes 14

Fig. 1. Dorsal view of a specimen which is rather coarsely plicated.
2. Profile view of the same.
3. View, enlarged one and a half diameters, of a finely plicated form.
4. A ventral valve showing bifurcating plications.

TEREBRATELLA PLICATA Say 12

Fig. 5. Dorsal view of a large individual.
6. Profile view of the same.
7. Ventral view of a different individual of large size.
8. Enlargement of the hinge portion of the last one to show the form of the foramen and plates.
9. Enlarged view of a dorsal valve showing the loop and its connection.

TEREBRATULINA ATLANTICA Morton 9

Fig. 10. Dorsal view of a cast showing very fine striæ and a flattened dorsal valve.
11. Copy of Conrad's figure of *T. glossa*.
12. Profile of a smaller crushed specimen.
13. Dorsal view of a specimen from Farmingdale, N. J.

TEREBRATULINA LACHRYMA Morton 12

Fig. 14. Enlarged dorsal view of a specimen from Charleston, S. C., introduced for comparison with the last.

TEREBRATULA HARLANI var. **FRAGILIS** Morton 7

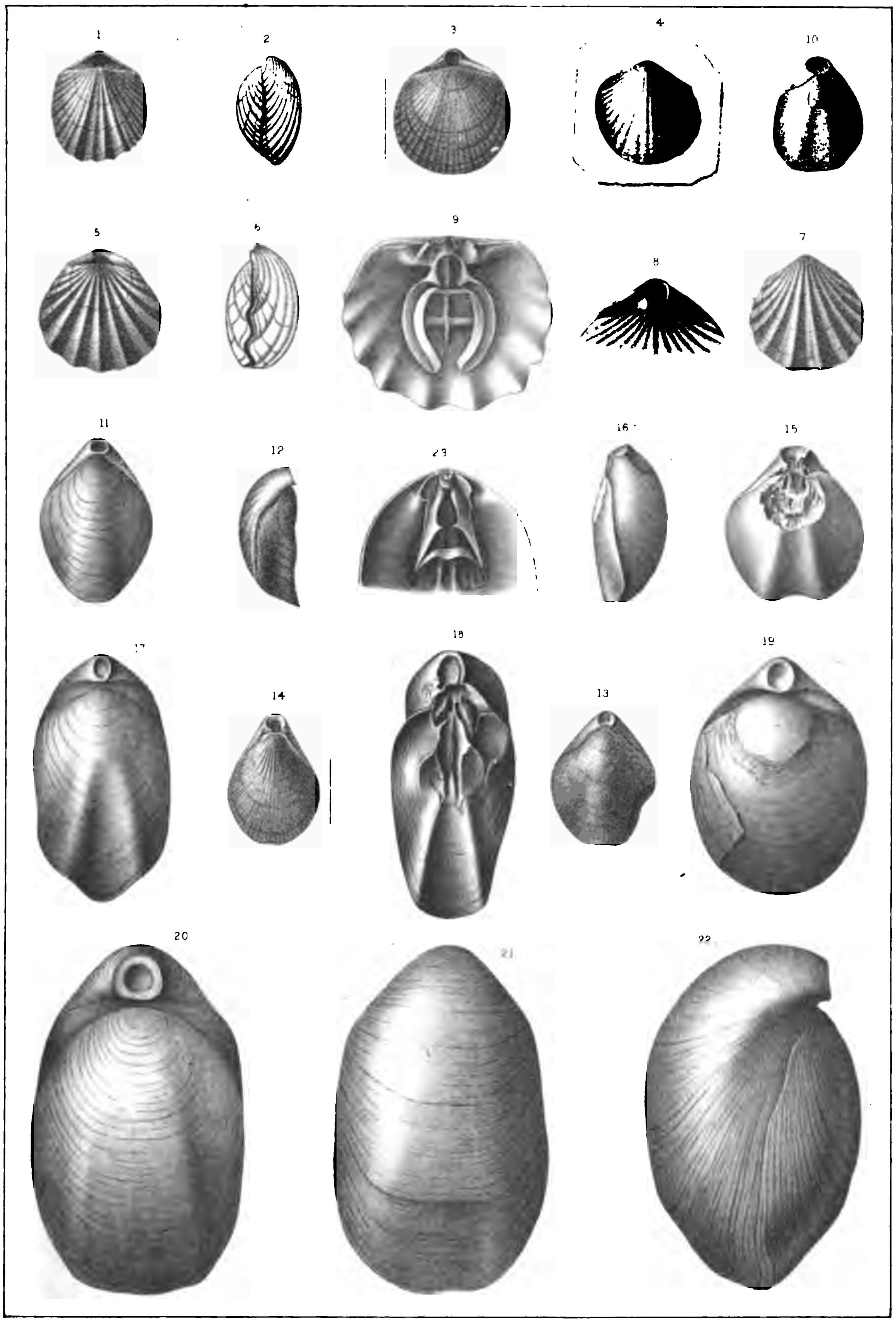
Fig. 15. Dorsal view of a cast of a young shell showing the strong plications at this age.
16. Profile view of the same.
17. Dorsal view of a specimen of the normal form.
18. Dorsal view of a partial cast showing an extremely narrow form.

TEREBRATULA HARLANI var. **PEROVALIS** Morton 8

Fig. 19. Dorsal view of a half-grown shell of T. Harlani possessing the features ascribed to this variety.

TEREBRATULA HARLANI Morton 8

Figs. 20–22. Three views of a full-grown specimen from near New Egypt, N. J., showing the absence of plications which are sometimes very distinct in as large ones as this.
23. View of the interior of the dorsal valve with the loop attached. The figure is restored from several specimens, but not exaggerated.



J. A. D. and R. P. W. del. T. Sinclair & Son, Phila.

BRACHIOPODA.

(CRETACEOUS AND TERTIARY.)

PLATE II.

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ASTARTE VETA Conrad 23

Fig. 1. Copy of Mr. Conrad's figure from the Am. Jour. Conch.

CORBICULA ANNOSA Conrad's sp 26

Fig. 2. Left side of a specimen from Sayers & Fisher's clay bank.
3. Left view of a larger specimen showing the form more distinctly.
4. Antero-cardinal view of the same.

CORBICULA EMACERATA Whitfield 26

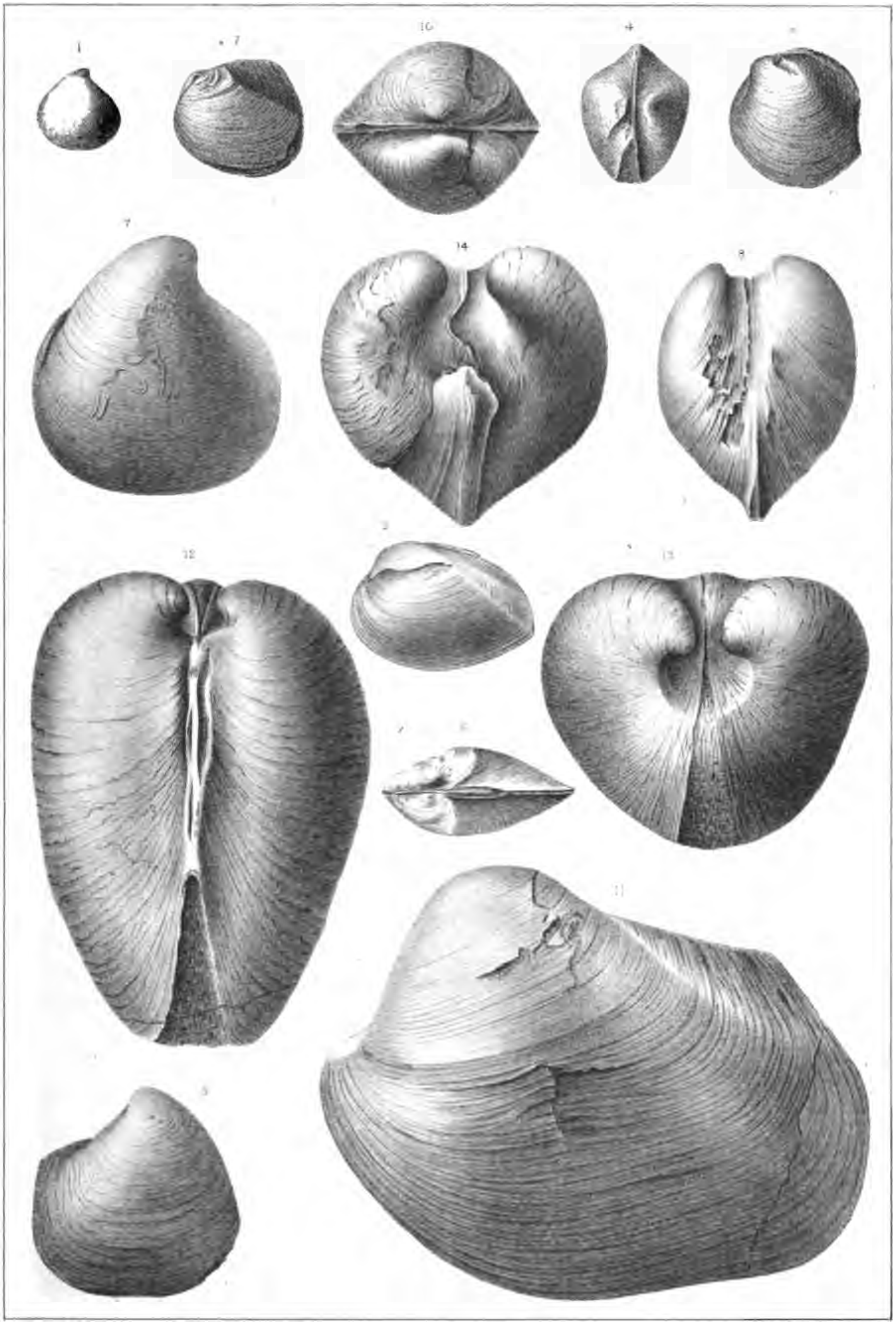
Fig. 5. Left view of the most perfect specimen seen.
6. Cardinal view of the same.

GNATHODON TENUIDENS Whitfield 27

Fig. 7. Right view of a very complete specimen showing the general form, and also marks of a lateral tooth.
8. Posterior view of the same.
9 and 10. Views of a smaller specimen.

AMBONICARDIA COOKII Whitfield 25

Fig. 11. Left side of a large specimen.
12. Cardinal view of another individual.
13. Anterior view of the specimen fig. 12.
14. Anterior profile view of a partial cast showing the evidence of a tooth in the left valve and a part of the pallial line on the right.



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LAMELLIBRANCHIATA.

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PLATE III.

Page

OSTREA TECTICOSTA Gabb 33

Fig. 1. Exterior of the type specimen.
2. Interior of the same.

OSTREA LARVA var. NASUTA Morton 34

Fig. 3. A specimen showing more than the usual number of plications.
4. Another individual with few plications.

OSTREA LARVA Lamarck 34

Fig. 5. Right side of a specimen of the usual character.
6. Opposite side of the same.
7. Interior of a specimen showing very many plications.

OSTREA DENTICULIFERA Conrad 29

Fig. 8. Exterior of a specimen identified and labeled by Mr. Conrad, from Haddonfield, N. J.
9. Interior of the same.

OSTREA CRENULIMARGINATA Gabb 30

Fig. 10. Exterior view of a single valve from Marlborough, N. J.
11. Interior view of the same.

OSTREA PLUMOSA Morton 31

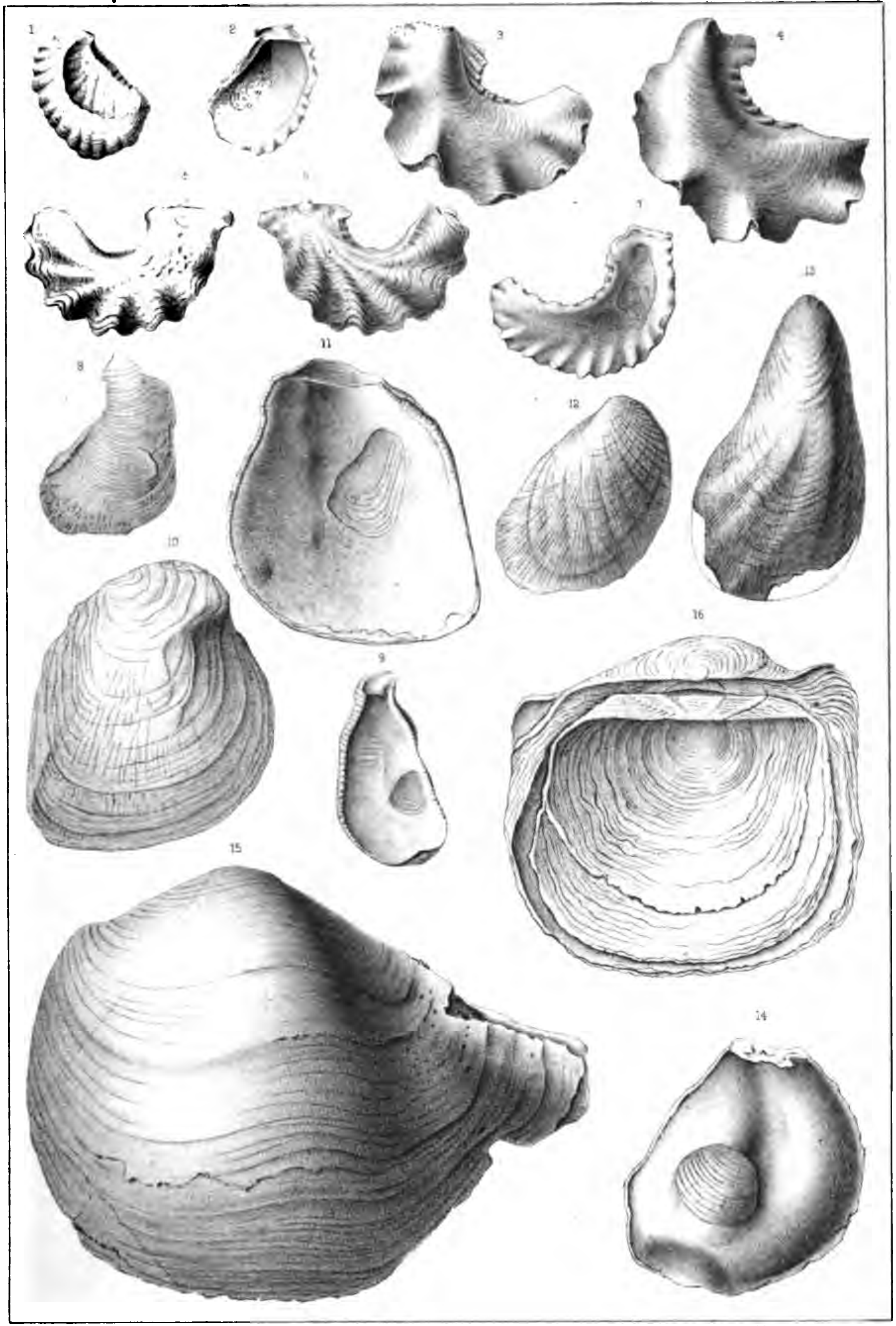
Fig. 12. View of Dr. Morton's type specimen.
13. View of a more elongate specimen.

OSTREA SUBSPATULATA ? Lyell 32

Fig. 14. View of a cast which is doubtfully referred to this species.

GRYPHÆA VESICULARIS Lamarck 36

Fig. 15. Exterior view of a specimen of the form described by Dr. Morton as *G. convexa*.
16. View of the upper side of a smaller form without the lateral extension. See Plate III, Fig. 2.



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(CRETACEOUS – LOWER MARL BEDS.)

PLATE IV.

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GRYPHÆA VESICULARIS Lamarck 36

Fig. 1. Exterior view of a specimen which somewhat approaches *G. Pitcheri* in form.
2. View of the upper side of the same.
3. View of the upper side of a large flat form having a deep lateral channel. See Pl. V, Fig. 2, for profile.

DIPLOSCHIZA CRETACEA Conrad 43

Figs. 4 and 5. Views of a broad specimen doubtfully of the species.
6–8. Copies of Mr. Conrad's figures of the type of the species.

ANOMIA ARGENTARIA Morton 42

Fig. 9. View of a large specimen referred to this species.
10. View of a valve having the specific markings described by Dr. Morton.
11. An enlargement of the surface of the same.

ANOMIA TELLINOIDES Morton 43

Fig. 12. View of a group of lower valves of this species.
13. Upper surface of a cast of both valves, showing the form of the perforation and indistinct wrinkles near the border of the valve.

U. S. GEOLOGICAL SURVEY. MONOGRAPH IX. PLATE IV.

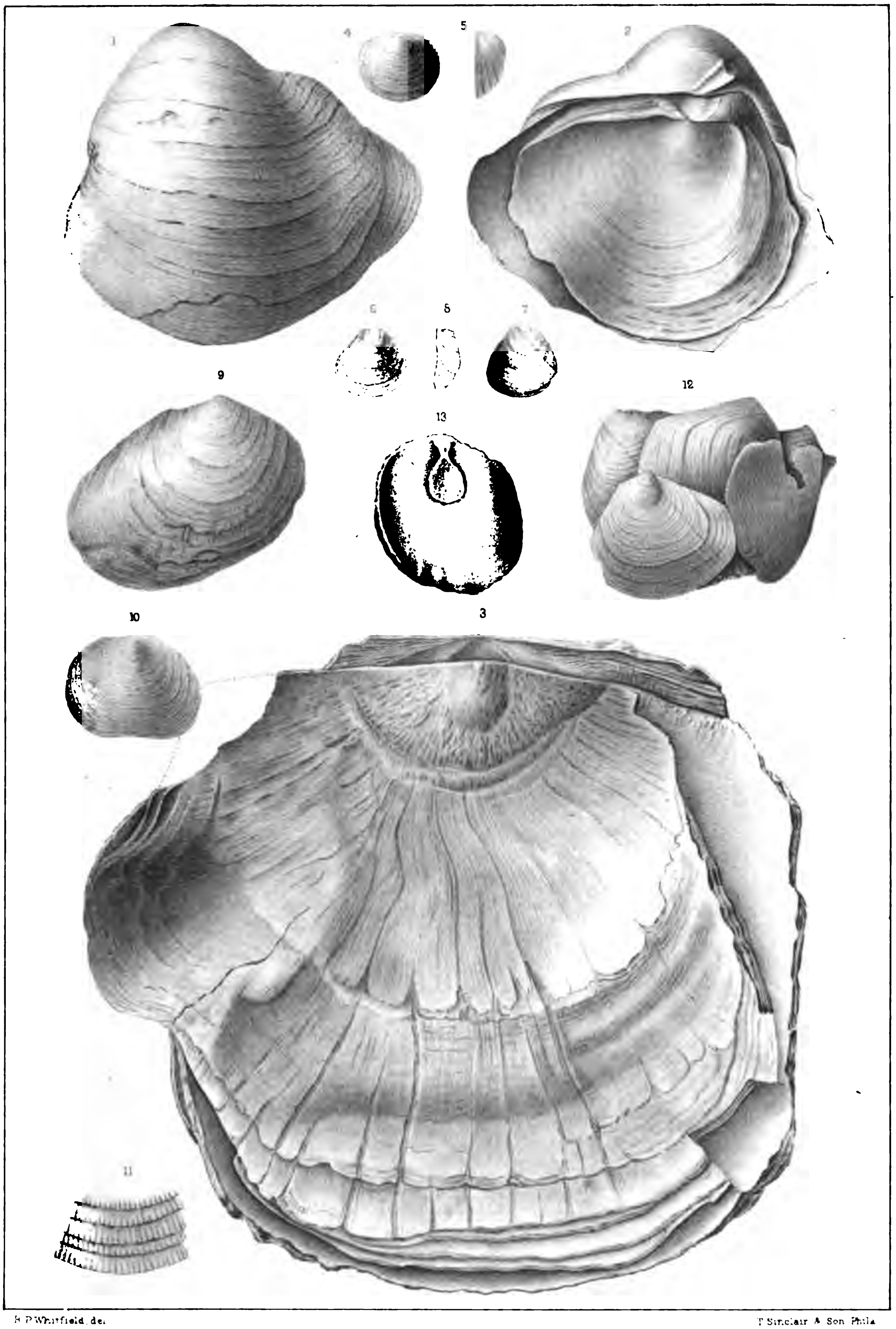

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PLATE V.

	Page.
GRYPHÆA VESICULARIS Lamarck	36

Fig. 1. Upper view of a large flat specimen of the form known under the generic name *Pycnodonta*.

2. Lateral view of the specimen shown on Plate IV, Fig. 3, showing the convexity and the depth of the lateral sinuosity.

3. Lateral view of the specimen, Pl. III, Fig. 16.

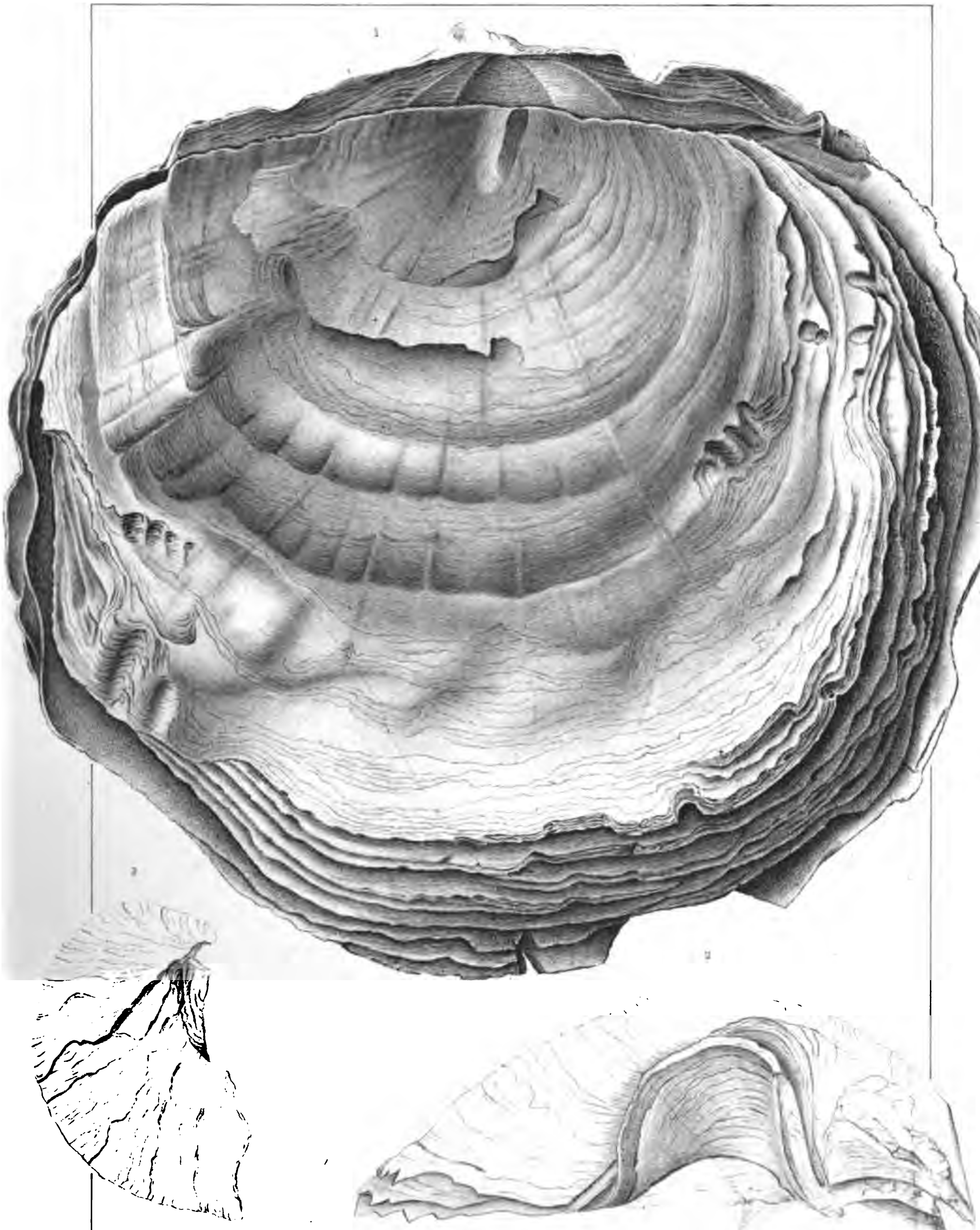

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PLATE VI.

Page.

Exogyra costata Say 39

Fig. 1. View of the upper side of a characteristic specimen of the species.

2. Opposite side of the same.

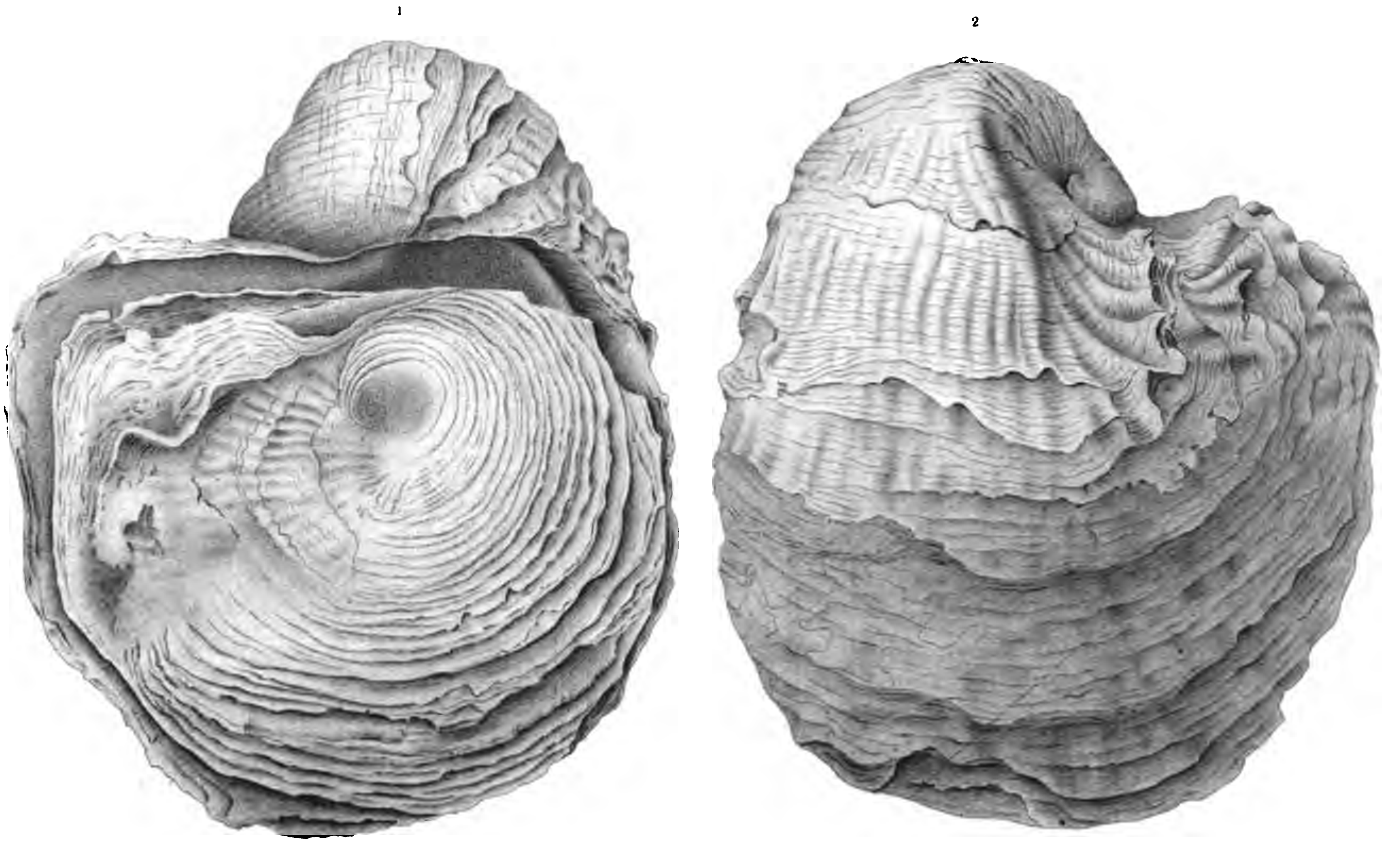

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PLATE VII.

	Page.
PECTEN VENUSTUS Morton	45
Fig. 1. View of a cast of a right valve enlarged to two diameters.	
2. Enlarged view of a right valve, preserving the shell, from Freehold, N. J.	
3. View of a left valve. The curved lines indicate the degree of convexity.	
4. Enlarged view of the hinge of the specimen, Fig. 3.	
PECTEN TENUITESTUS Gabb	4
Fig. 5. View of a left valve, the shell preserved.	
6. View of another left valve, showing a different degree of ornamentation.	
PECTEN (SYNCYCLONEMA ?) PERLAMELLOSUS Whitfield	50
Fig. 7. View of the specimen described, natural size.	
AMUSIUM CONRADI Whitfield	52
Fig. 8. View, enlarged, of a left valve showing indistinct radii.	
9. Enlarged view of a right valve showing the concentric lines.	
10. Enlargement of the concentric lining of the right valve.	
AMUSIUM SIMPLICUM Conrad	51
Figs. 11 and 12. Enlarged views of specimens of this species from Eufaula, Ala., the typical locality of the species. The lines between these figures show the convexity.	
PECTEN QUINQUENARIUS Conrad	47
Fig. 13. View of a small right valve from the limestone nodules at Marlborough, N. J.	
14 and 15. Impressions in fine micaceous clay, from Freehold.	
16. Enlargement of the surface from Fig. 14.	
PECTEN (CHLAMYS) CRATICULUS Morton	49
Figs. 17 and 18. Views of Dr. Morton's type, the largest fragment I have seen of the species.	

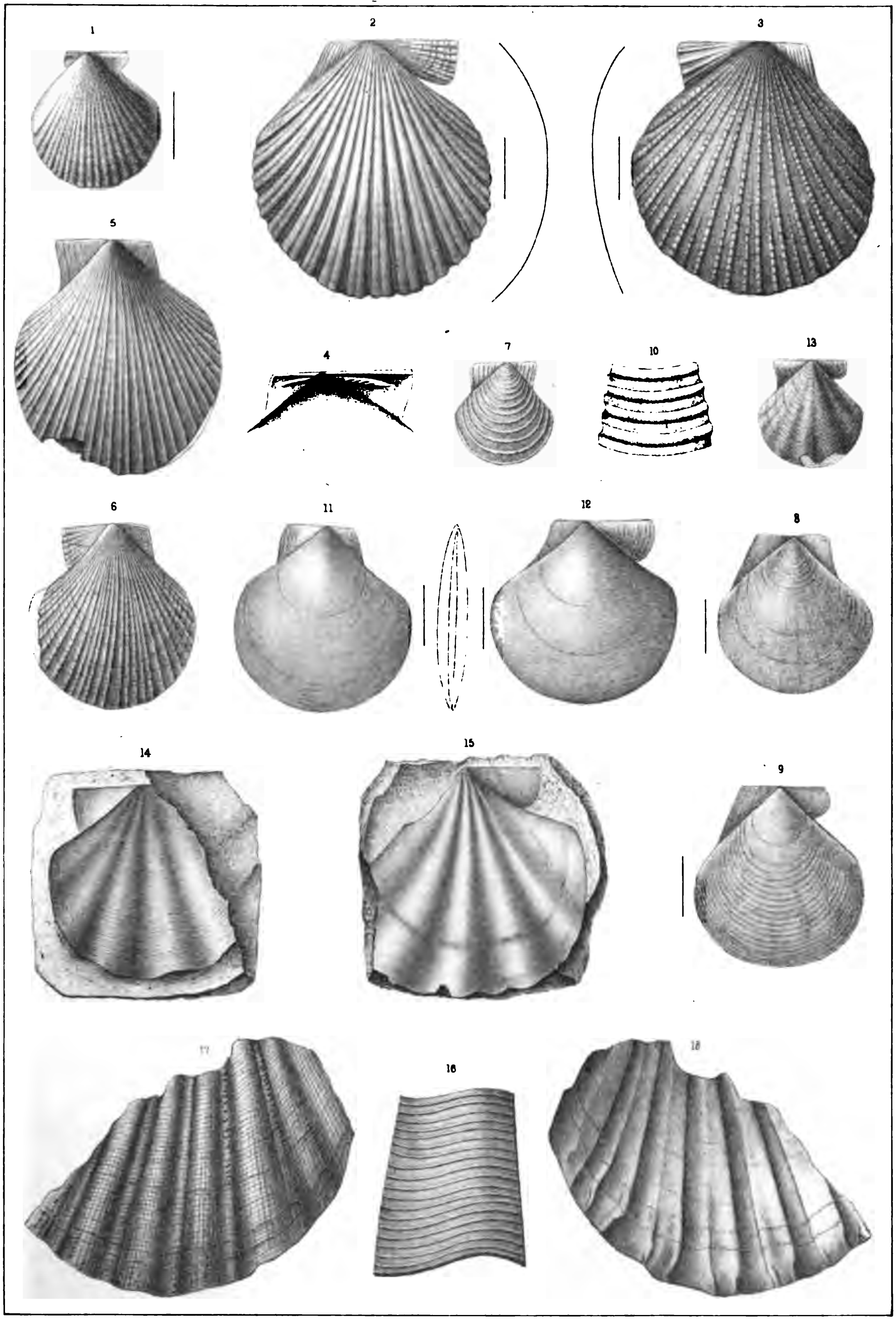

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PLATE VIII.

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CAMPTONECTES PARVUS Whitfield 55

Fig. 1. View of the left valve. Enlarged three diameters. The curved line shows the convexity of the valve.

2. Enlargement of the surface, showing the impressed and interrupted striæ.

CAMPTONECTES BURLINGTONENSIS Gabb 53

Fig. 3. View of left valve of a small shell.

4. An enlargement of the surface of the same, showing its features.

5. A right valve of similar size.

6. An enlargement of the surface of the same from near the margin. Both this and the last are from the typical specimens used by Mr. Conrad in the description of *C. bellisculptus*.

7. View of a large imperfect valve from Freehold, retaining a part of the shell.

8. View of Mr. Gabb's type, which is a cast from Burlington, N. J.

9. View of a small valve, showing the striæ, from Freehold.

PECTEN PLANICOSTATUS Whitfield 48

Fig. 10. View of a left valve, showing the smooth flattened ribs

11. Enlargement of the surface showing the form of rib, and the fine, even, concentric striæ.

NEITHEA QUINQUECOSTATA Lamarck 56

Figs. 12 and 13. Views of a very large lower valve of the species; being only a cast and imperfect, it does not fully show the features of the ribs.

Fig. 14. View of a small upper valve, from a gutta-percha impression in the natural mold, Holmdel, N. J.

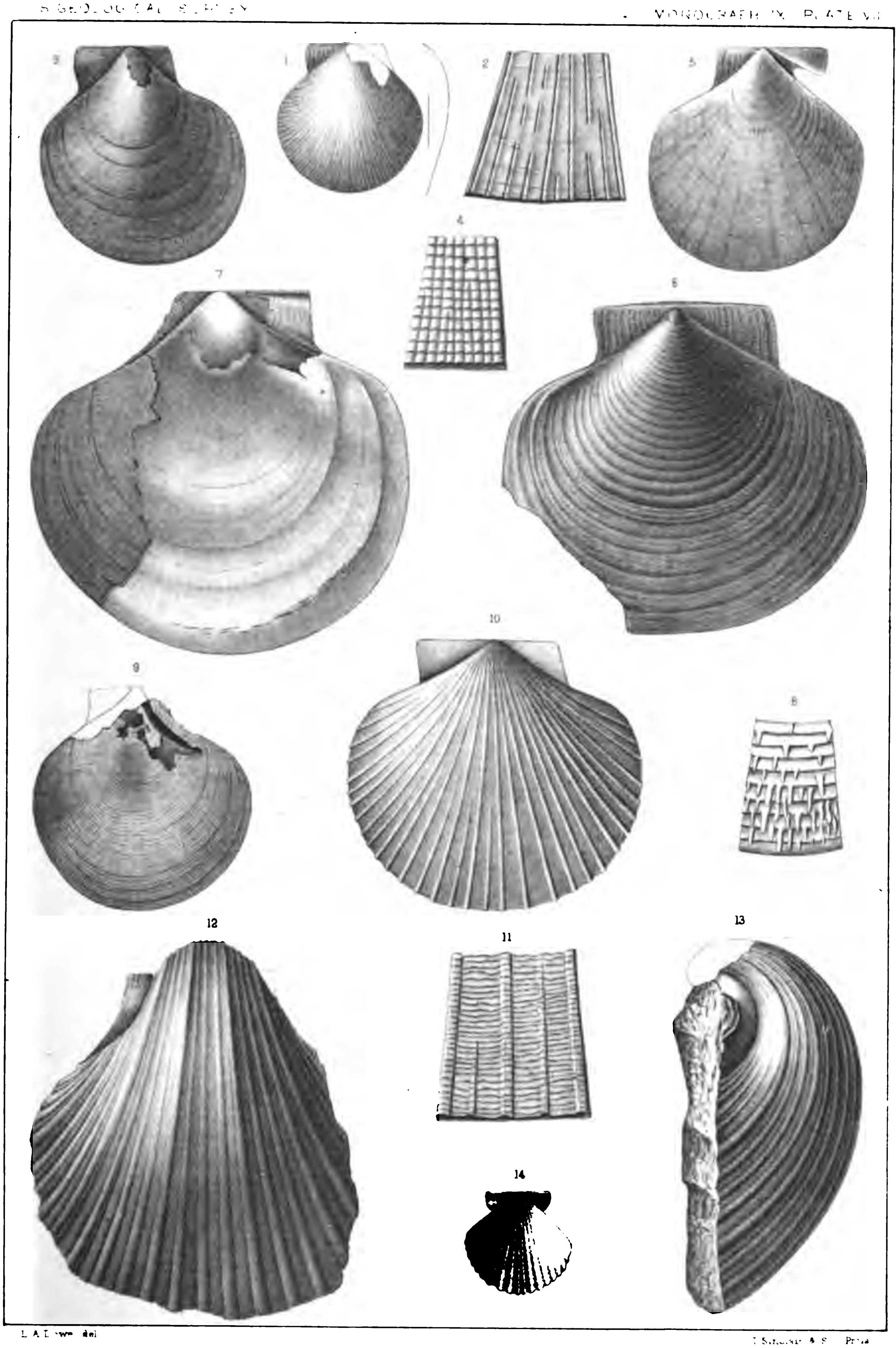

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PLATE IX.

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PLICATULA URTICOSA Morton 61

Fig. 1. View of a specimen from Freehold, N. J.

2. View of a different individual, showing considerable variation in surface characters from the last.

RADULA PELAGICA Morton 61

Fig. 3. View of the right side of a specimen preserving a portion of the shell, and showing angular plications; from Holmdel, N. J.

4. View of a smaller shell, entire, with rounded plications, from the limestone nodules at Holmdel, N. J.

5. Posterior view of a specimen from Holmdel, showing the curvature of the shell.

RADULA ACUTILINEATA Conrad 62

Fig. 6. Enlarged view of a shell from Haddonfield, N. J., showing the narrow radii.

7. Enlargement of the surface of the same.

RADULA RETICULATA Lyell and Forbes 63

Fig. 8. A view, enlarged to two diameters, of a shell from Upper Freehold, N. J.

9. Profile view of the same, showing its convexity.

PARANOMIA LINEATA Conrad 45

Fig. 10. View of an upper valve of this species, imperfect at the upper edge.

SPONDYLUS GREGALIS Morton 57

Figs. 11 and 12. Views of a very fair lower valve of large size, showing the features very perfectly. The shell shows a perforation made by some boring mollusk during life.

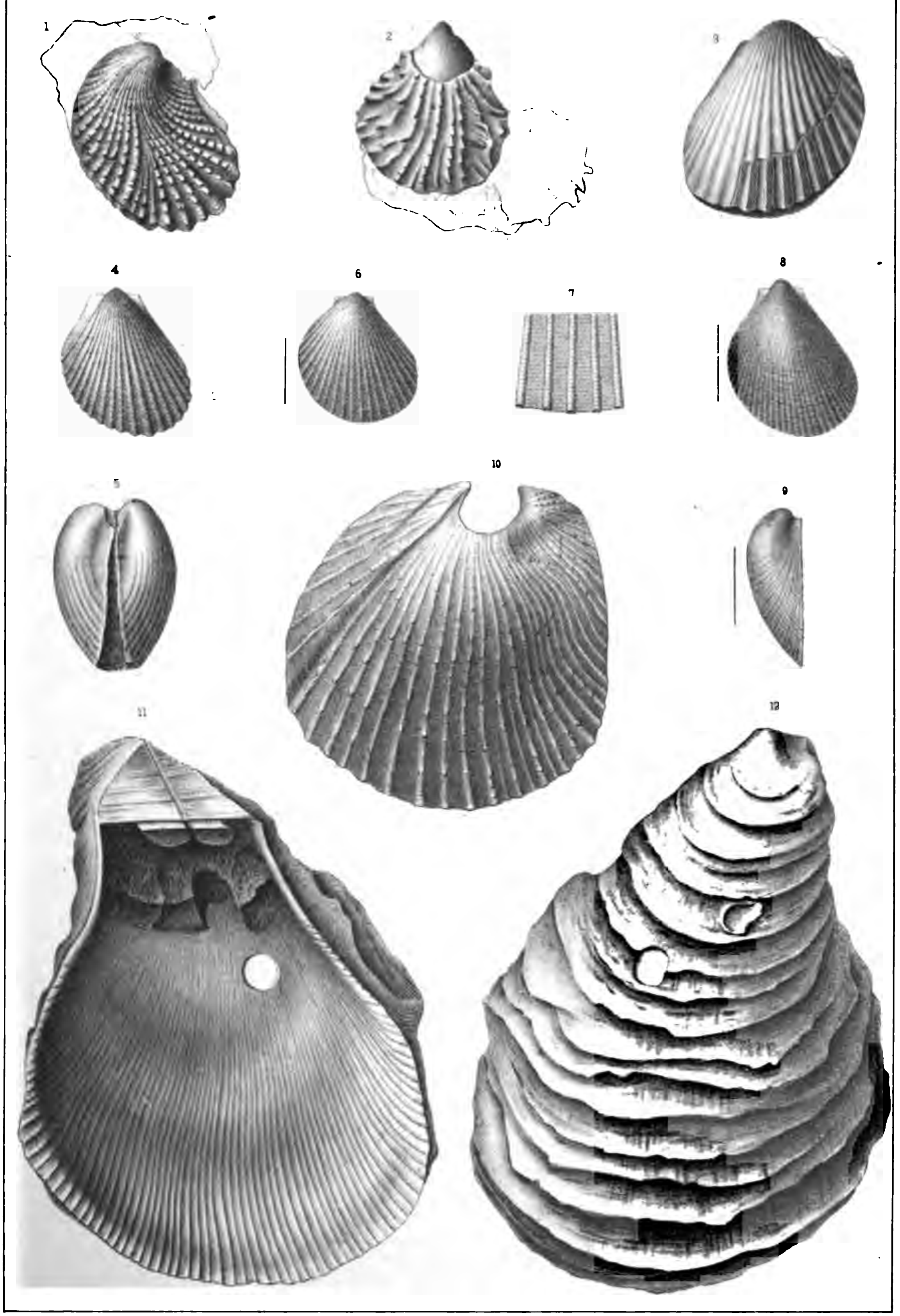

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PLATE X.

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Spondylus gregalis Morton 57

Fig. 1. View of the upper side of a cast showing the muscular scar. From Upper Freehold, N. J.

2. View of the lower side of a smaller specimen.

Dianchora echinata Morton 59

Figs. 3–5. Three views of a nearly entire upper valve preserving the surface structure, and the margins of the foramen entire. Morton's type.

6. A young lower valve having a fragment of foreign shell attached at the apex. Holmdel, N. J.

7. View of lower valve attached to *Exogyra costata*. Freehold, N. J.

8. View of a similar valve attached to *Gryphæa vesicularis*.

9. Cardinal view of a specimen preserving the lower valve and part of the upper, the most of the latter being internal cast.

Paranomia scabra Morton 44

Fig. 10. View of the type specimen of Dr. Morton. I have seen no entire individual valves, and only a few other fragments.

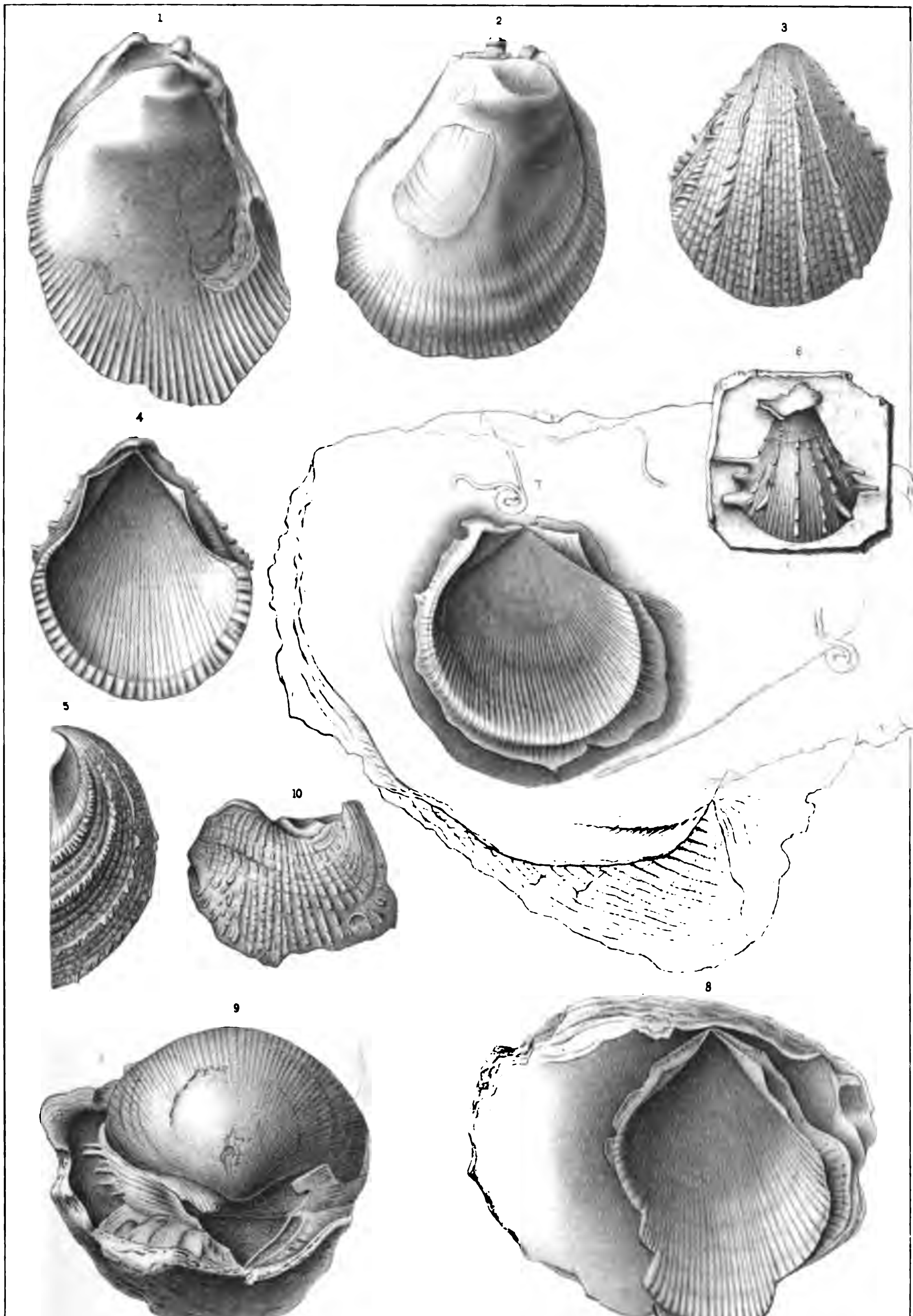

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PLATE XI.

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Nucula Monmouthensis Whitfield 102

Fig. 1. View of a left valve, natural size.

Nucula Slackiana Gabb 103

Fig. 2. View of the right side of the type specimen.
3. Left valve of a larger example.

Nucula percrassa Conrad 102

Fig. 4. View of a specimen from the micaceous clays below the Lower Marls near Marlborough, N. J.
5 and 6. Views of a cast supposed to be from Haddonfield.

Nuculana pinnaformis Gabb 108

Fig. 7. View of the type specimen, enlarged three diameters.
8. View of a more elongated form, presumably of the same species, enlarged four diameters.

Nuculana compressifrons Conrad 109

Fig. 9. View of one of the type specimens greatly enlarged.

Nuculana protexta Gabb 105

Fig. 10. View of the specimen figured by Mr. Gabb as the type of the species, partially restored.

Nuculana Gabbana Whitfield 106

Fig. 11. View of a small individual corresponding to Mr. Gabb's figure.
12 and 13. Views of the specimen from Princeton College; both enlarged.

Perrisonota protexta Conrad 110

Fig. 14. Enlarged view of the type specimen.
15. A further enlargement of the hinge.

Nuculana longifrons Conrad 107

Fig. 16. Exterior of one of the type specimens.
17. Enlargement of the hinge showing the teeth.

Nucularia papyria Conrad 111

Fig. 18. View of a shell enlarged.
19. View of a cast of a right valve, enlarged.
20. Enlargement of a fragment preserving a few of the teeth. The specimens are all from the original types.

Cibota multiradiata Gabb 94

Fig. 21. Left view of the type specimen, natural size.
22. Cardinal view of the same.

Axinea Mortoni Conrad 99

Fig. 23. Right view of a specimen preserving the shell.
24. Cardinal view of the same.
25. A cast showing the character of the teeth.

Axinea alta Whitfield 101

Fig. 26. Lateral view of a cast, showing the elevated beaks, etc.
27. Profile view of the same.
28. View of a cast which preserves the form of the teeth in part.
29. View of a similar cast, showing the crenulations of the margin.

Cibota obesa Whitfield 93

Fig. 30. Right view of the specimen described.
31. Basal view of the same.

Cibota uniopsis Conrad ....

Fig. 32. Left view of a cast of the species. Collection of the American Museum of Natural History. 92
33. Cardinal view of the same.

Cibota rostellata Morton 91

Fig. 34. Right view of a characteristic example of the species (a cast).
35. Cardinal view of the same.
36. View of a cast of a left valve, retaining the surface features more distinctly marked than on the other.

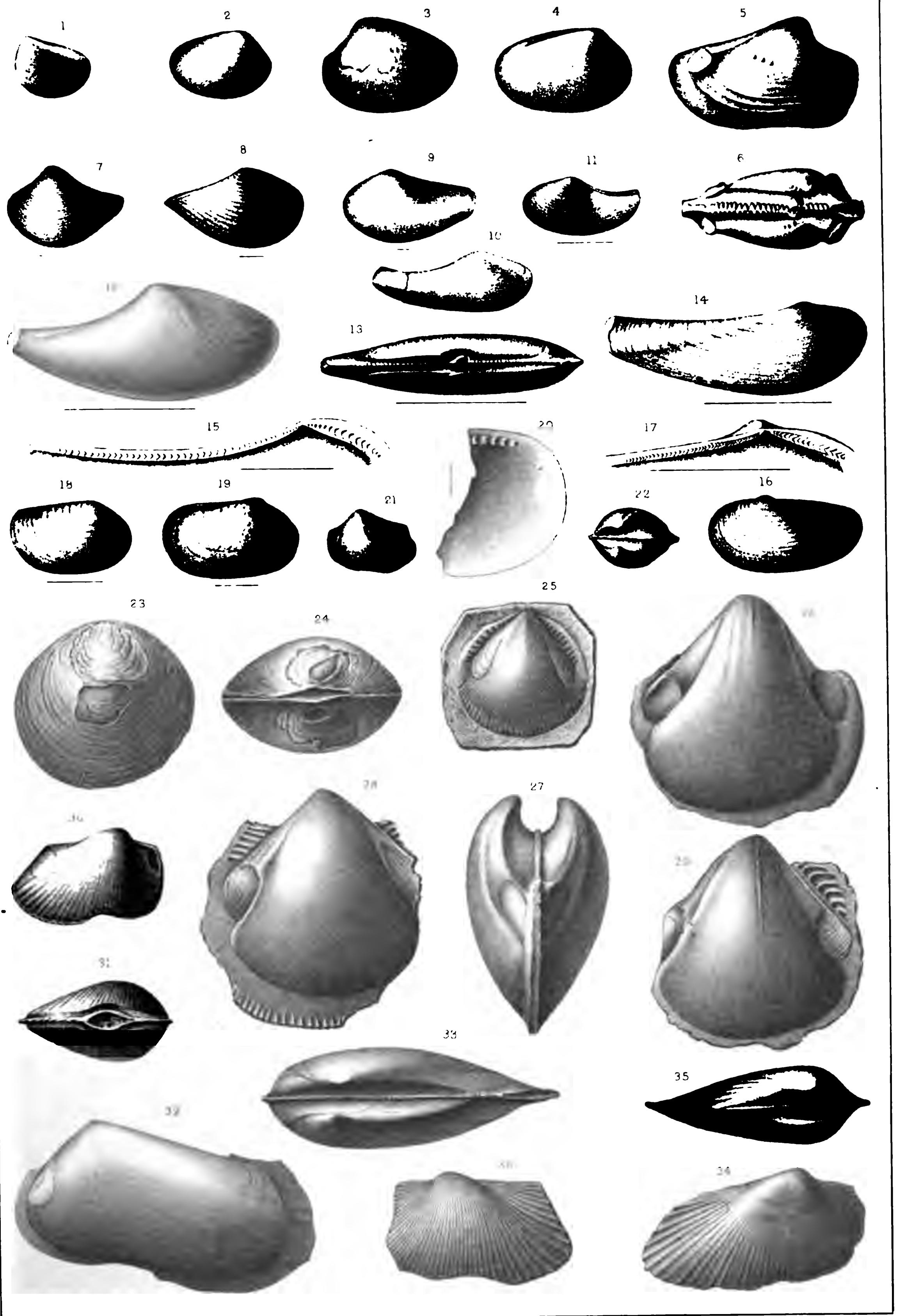

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PLATE XII.

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Nemodon brevifrons Conrad 85

Fig. 1. View of a specimen identified and labeled by Mr. Conrad, from Haddonfield, N. J.
2. Enlarged view of the hinge of the same.

Nemodon Eufaulensis Gabb 83

Fig. 3. View of a partial cast from the limestone nodules of the Lower Marls at Holmdel, N. J.
4. Enlargement of the hinge of the same.
5. Enlargement (two diameters) of a specimen from Haddonfield, N. J., one of the types.

Nemodon angulatum Gabb 84

Fig. 6. View of the type specimen, natural size.
7. Enlarged cardinal view of the same.

Nemoarca Cretacea Conrad 86

Fig. 8. Enlargement to two diameters of a cast from the iron nodules from Keyport, N. J.
9. View of the exterior (three diameters) of one of the type specimens.
10. Diagram of the hinge of the same.

Breviarca Saffordi Gabb 87

Fig. 11. View of the exterior, natural size, of one of the type specimens, from Haddonfield, N. J.
12. Enlargement of the hinge of the same.

Arca (Trigonarca) transversa Gabb 89

Fig. 13. Left side of a specimen from Mullica Hill, N. J.
14. Right view of Mr. Gabb's type specimen.
15. Cardinal view of the same.
16. View of a small cast, more angular on the umbonal ridge than the others, and showing the hinge features.

Trigonarca cuneiformis Conrad 88

Fig. 17. Enlarged view of the exterior of the type specimen, Haddonfield, N. J. (seven diameters).
18. Outline view of the interior of the same equally enlarged.

Idonearca Tippana Conrad 95

Fig. 19. View of the cast of a left valve from the deep cut of the Holmdel and Keyport turnpike, N. J.
20. Outline profile of the same, showing convexity.
21. Inside of a valve from near Prairie Bluff, Ala., to show the hinge features.

Arca altirostris Gabb 82

Fig. 22. Right view of the original type of the species.
23. Cardinal view of the same.

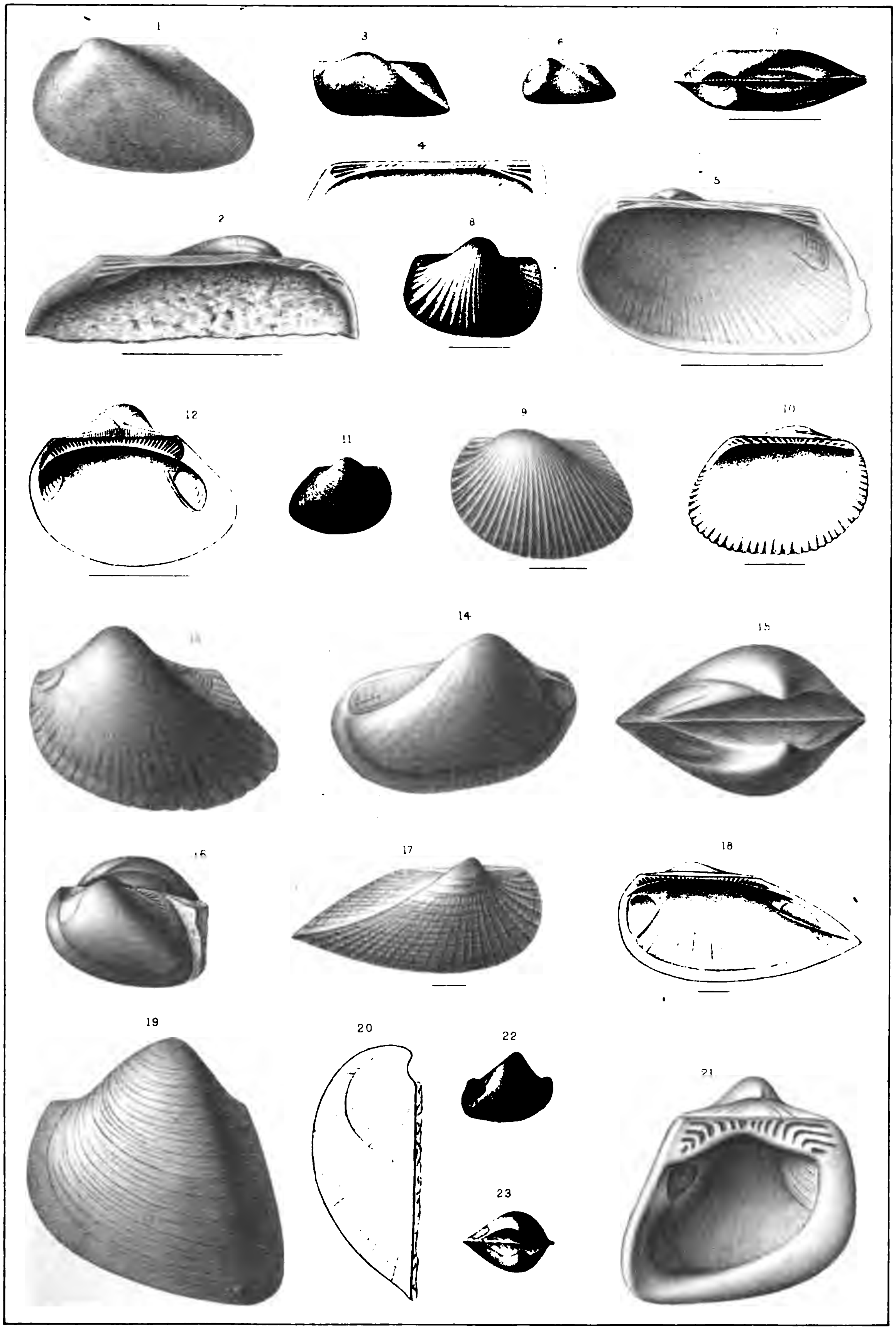

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PLATE XIII.

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IDONEARCA VULGARIS Morton 98

Fig. 1. Lateral view of a cast of the usual form of the species.
2. Anterior profile view of the same.
3. Lateral view of a cast of an old and thickened specimen.
4. Cardinal view of the same.
5. View of a cast of a single valve, showing the outline of the shell and teeth.

IDONEARCA ANTROSA Morton 96

Fig. 6. Lateral view of a cast of medium size.
7. Anterior profile view of the same.
8. Lateral view of another, larger but imperfect cast.
9. Anterior profile view of the same.
10. View of the exterior of a specimen from the limestone nodules from Holmdel, N. J. This is the form described by Mr. Gabb as *I. neglecta.*
11. View of a cast which retains the shell on one valve partially showing the teeth, which are represented on the posterior side as obtained from a gutta-percha cast in the shell of the opposite valve.

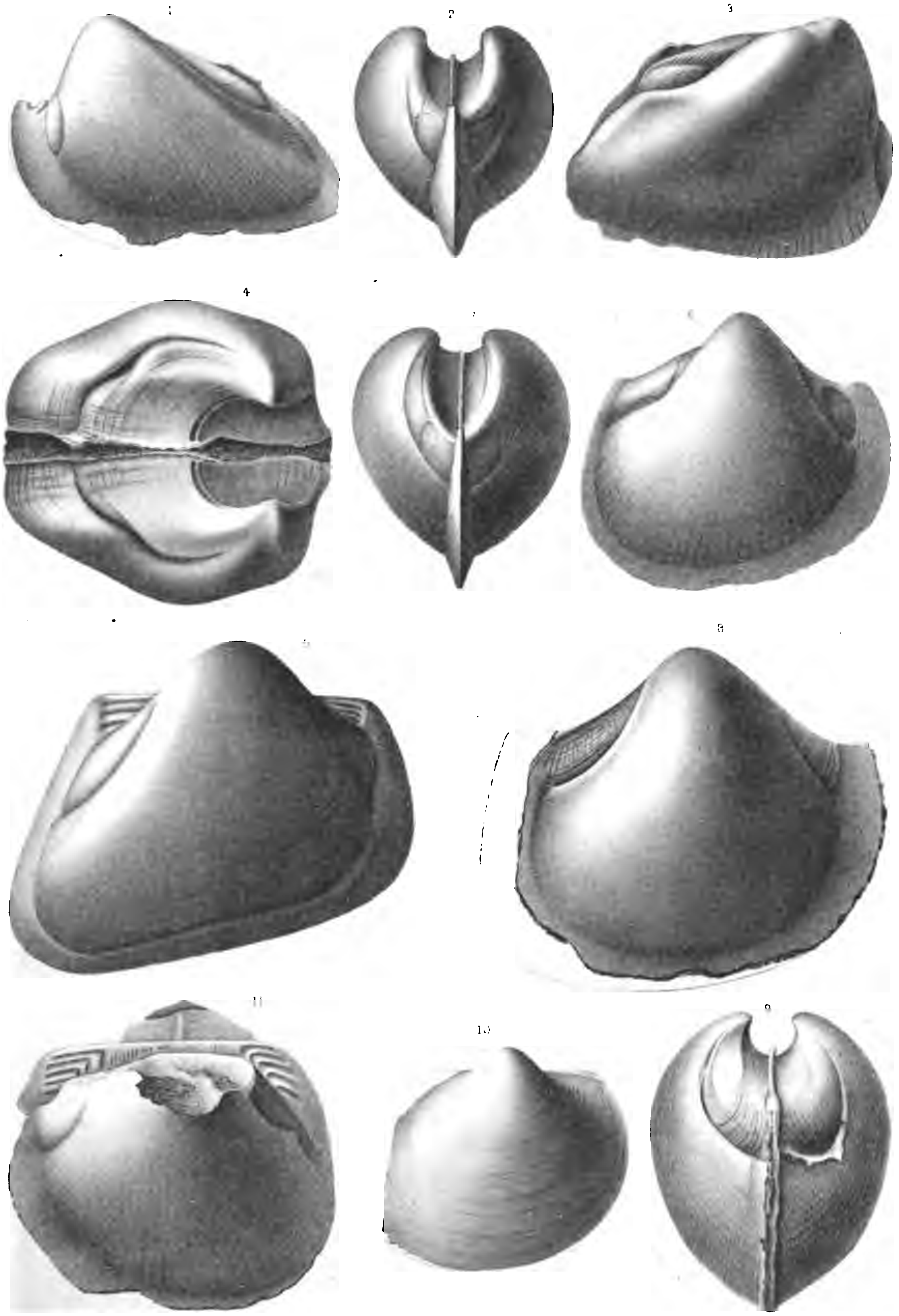

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PLATE XIV.

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TRIGONIA EUFAULENSIS Gabb 113

Fig. 1. Exterior of a specimen from near Red Bank, N. J., in the collection of the Academy of Natural Science, Philadelphia.
2. Interior of same.
3. A small cast from Monmouth County, New Jersey.
4. View of a cast from Shultz's Mills, near Long Branch, N. J.

TRIGONIA MORTONI Whitfield 112

Fig. 5. Left view of an internal cast of the usual form from Freehold, N. J.
5a. Cardinal view of same.
6. View of an imperfect impression of the left side as obtained from a gutta-percha cast in the natural mold, Holmdel, N. J.

TRIGONIA CERULEA Whitfield 114

Fig. 7. View of a right valve, natural size, showing the form and the style of ribs characteristic of the species.

PTERIA NAVICULA Whitfield 70

Fig. 8. View, twice enlarged, of the type specimen.

PTERIA LARIPES Morton sp 69

Fig. 9. View of a left valve of this species.

PTERIA PETROSA Conrad's sp 68

Fig. 10. View of an imperfect cast from an iron nodule from Keyport, N. J.

MELEAGRINELLA ABRUPTA Conrad sp 72

Fig. 11. View of a left valve, natural size.
12. Enlargement of the hinge from the same.
13. Enlargement of the exterior of a right valve from Freehold, N. J.
14. Enlargement of the interior of the same specimen.

INOCERAMUS SAGENSIS Owen 76

Fig. 15. View of an imperfect right (convex) valve from the limestone nodules at Holmdel, N. J.

INOCERAMUS SAGENSIS var. QUADRANS Whitfield 79

Fig. 16. View of the specimen described.

INOCERAMUS PRO-OBLIQUA Whitfield 80

Fig. 17. View of the type specimen, showing its features.

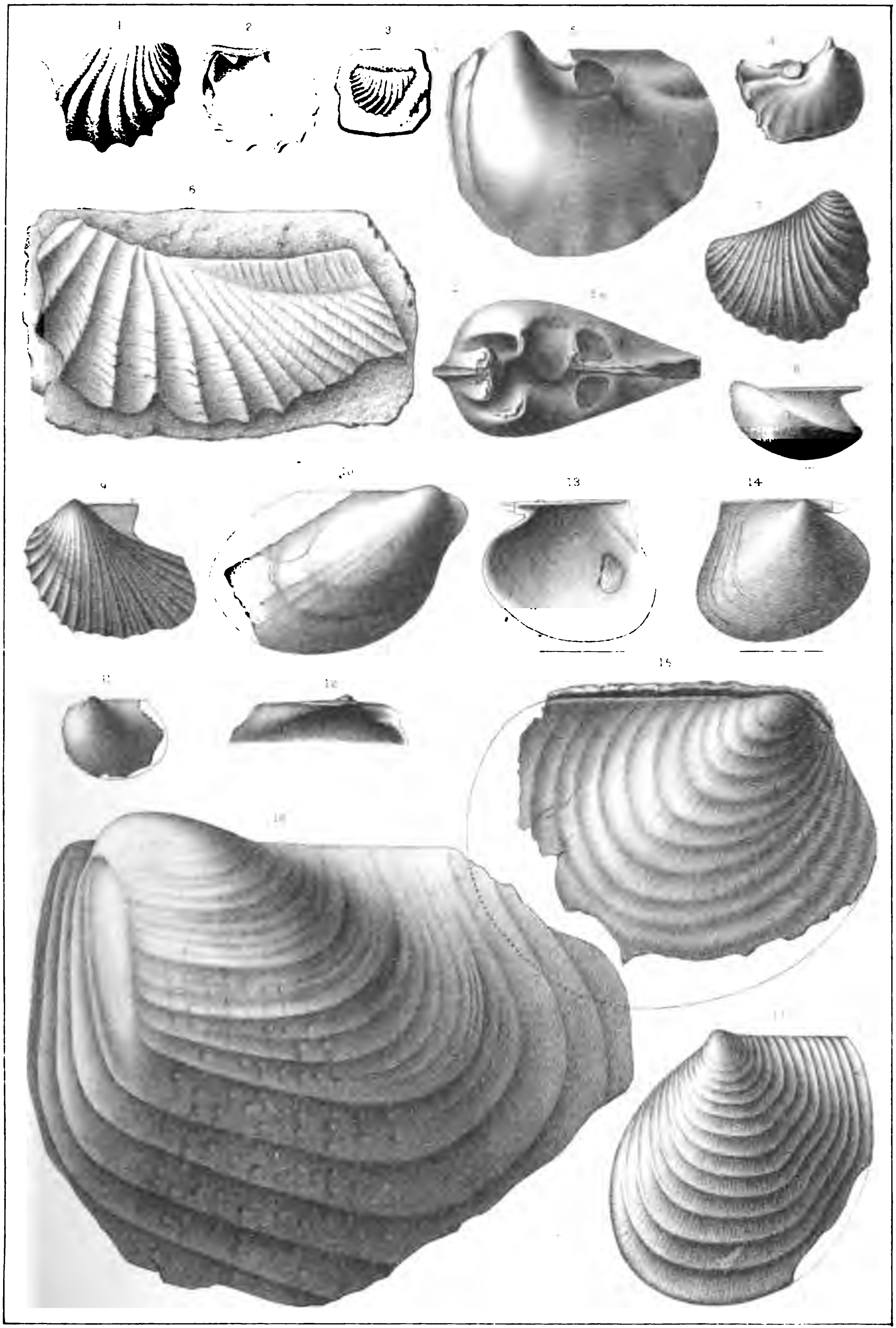

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PLATE XV.

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INOCERAMUS SAGENSIS var. VANUXEMI 76

Fig. 1. View of a left valve from Keyport, N. J. The specimen is quite flat with the undulations very sharply defined.

INOCERAMUS SAGENSIS Owen 76

Fig. 2. View of an imperfect convex right valve from Keyport, N. J., with broad, rounded undulations. There are spots in the position of the receding muscular scars.

INOCERAMUS BARABINI Morton 75

Fig. 3. View of an imperfect right valve, which is quite convex, from Freehold, N. J.
4. View of a specimen from Marlborough, N. J.
5. Cardinal view of same, showing its convexity.

INOCERAMUS ? PEROVALIS Conrad 80

Fig. 6. View of the right side of a cast, which is Mr. Conrad's type of the species.

GERVILLIOPSIS MINIMA Whitfield 74

Fig. 7. Enlarged view of the right side of the cast described.

GERVILLIOPSIS ENSIFORMIS Conrad 73

Fig. 8. View of the inside of an imperfect left valve, showing muscular impressions, area, etc. The anterior end is slightly restored at the thickened part.
9. Basal view of the anterior end of the large specimen figured on Plate X, fig. 5, showing the anterior opening.
10. View of a cast of a large left valve, showing the peculiar muscular scars; a, anterior ?; p, posterior; c and d, probably pedal scar.
11. View of the anterior end of a cast. One of those used by Mr. Conrad in the original description of the species.

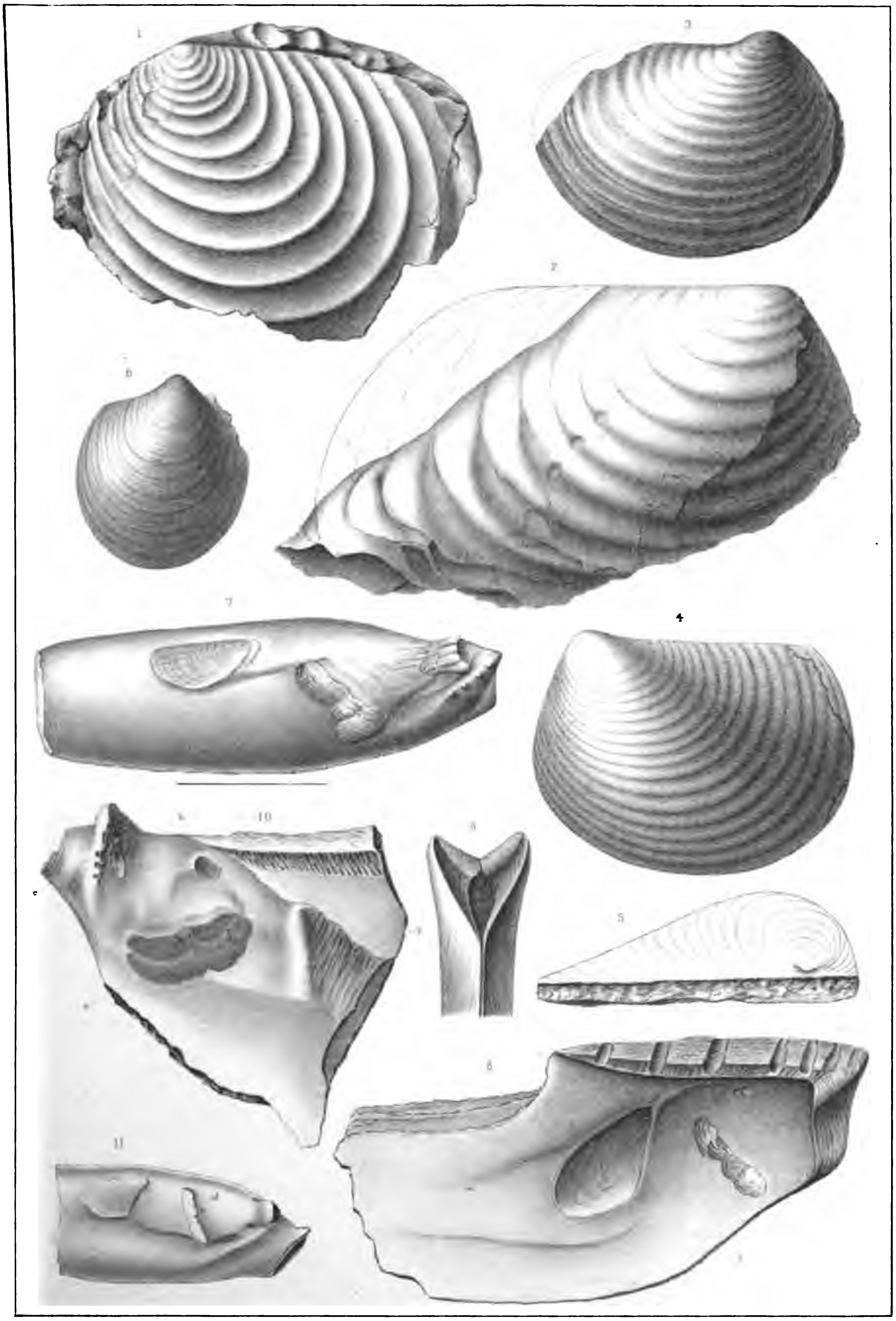

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PLATE XVI.

Page.

PINNA LAQUEATA Conrad 81

Fig. 1. Lateral view of a large, imperfect specimen from Burlington, N. J.

2. A similar view of a smaller specimen from Haddonfield, N. J., retaining the outline of the posterior margin.

PINNA ROSTRIFORMIS Morton 198

Fig. 3. Lateral view of a specimen from the Middle Marls at Timber Creek, New Jersey.

4. Lateral view of another specimen from the same locality.

GERVILLIOPSIS ENSIFORMIS Conrad's sp 73

Fig. 5. View of a large, nearly perfect specimen from Woodbury, Gloucester County, New Jersey.

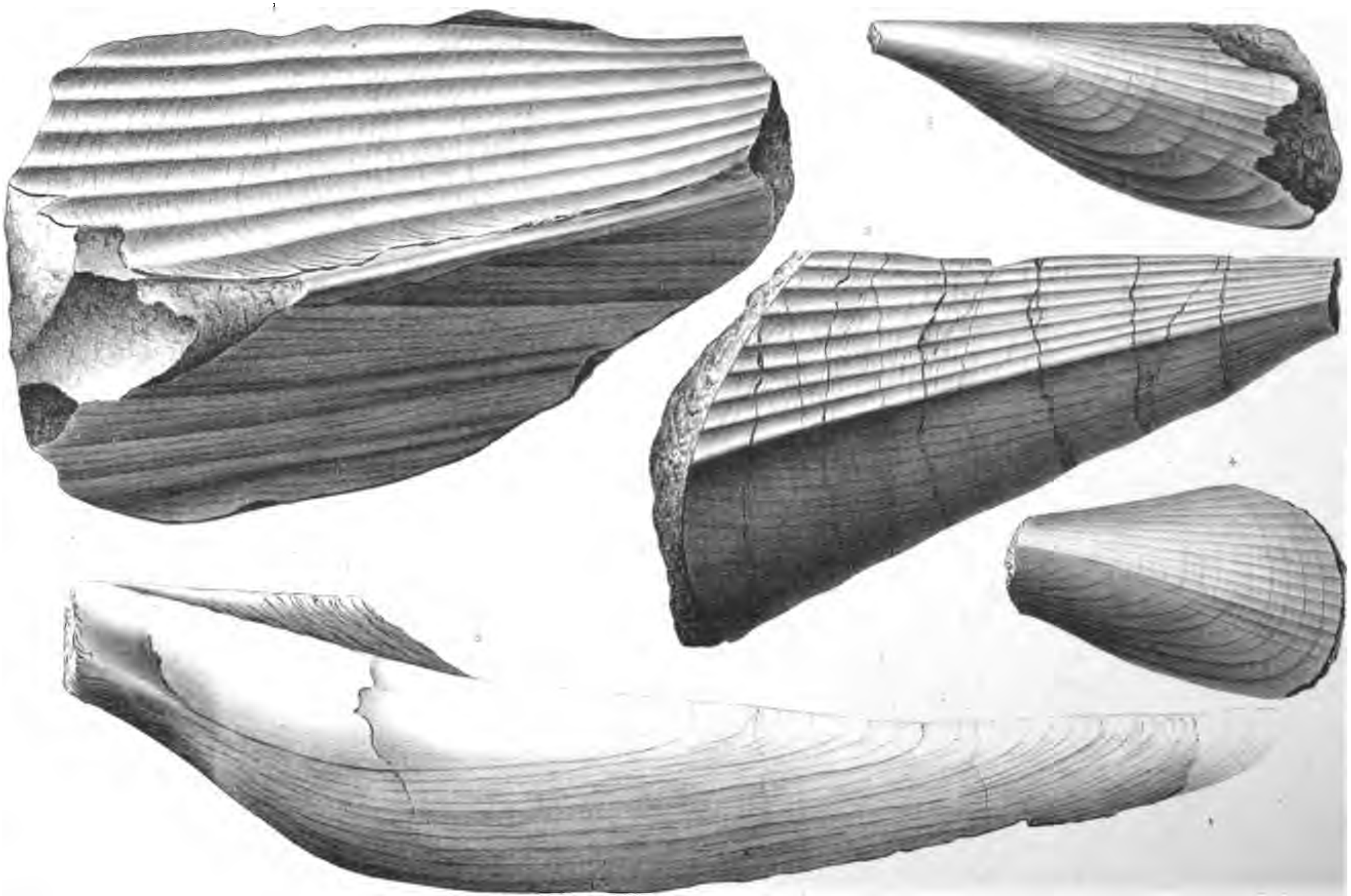

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PLATE XVII.

Page.

Mytilus oblivius Whitfield 64
  Fig. 1. View of the only specimen known, natural size.

Lithodomus affinis Gabb 66
  Fig. 2. Lateral view of Mr. Gabb's type specimen, natural size.
  3. Cardinal view of the same.

Lithodomus Ripleyana Gabb 67
  Fig. 4. Lateral view of a very entire cast of a shell, showing the callus at the posterior end; one of the originals.
  5. View of a group of the burrows which have been made in wood, from Mullica Hill, N. J.

Modiola Julia Lea 64
  Fig. 6. Lateral view of Mr. Lea's type, twice enlarged.
  7. View of a specimen from another locality, natural size, doubtfully referred to this species. *Comp. M. Johnsoni.*

Modiola Burlingtonensis Whitfield 65
  Fig. 8. Lateral view of the type specimen, from Burlington, N. J.
  9. Cardinal view of the same.

Crassatella (Etea) prora Conrad 120
  Fig. 10. Lateral view of the type.
  11. Cardinal view of the same.

Crassatella vadosa Morton 116
  Fig. 12. Right view of an internal cast.
  13. Cardinal view of the same.
  14. View of a specimen preserving some of the shell substance, showing the concentric markings. From Freehold, N. J.
  15. Similar view of another specimen from the same locality.

Crassatella transversa Gabb 122
  Fig. 16. Lateral view of the type specimen.
  17. Cardinal view of the same.

Crassatella cuneata Gabb 118
  Fig. 18. View of a specimen, natural size.
  19 and 20. Views of a cast of this species, enlarged to two diameters.

Crassatella Monmouthensis Gabb 119
  Fig. 21. View of the right side of a cast of this species, Mr. Gabb's type.
  22. Similar view of another cast.

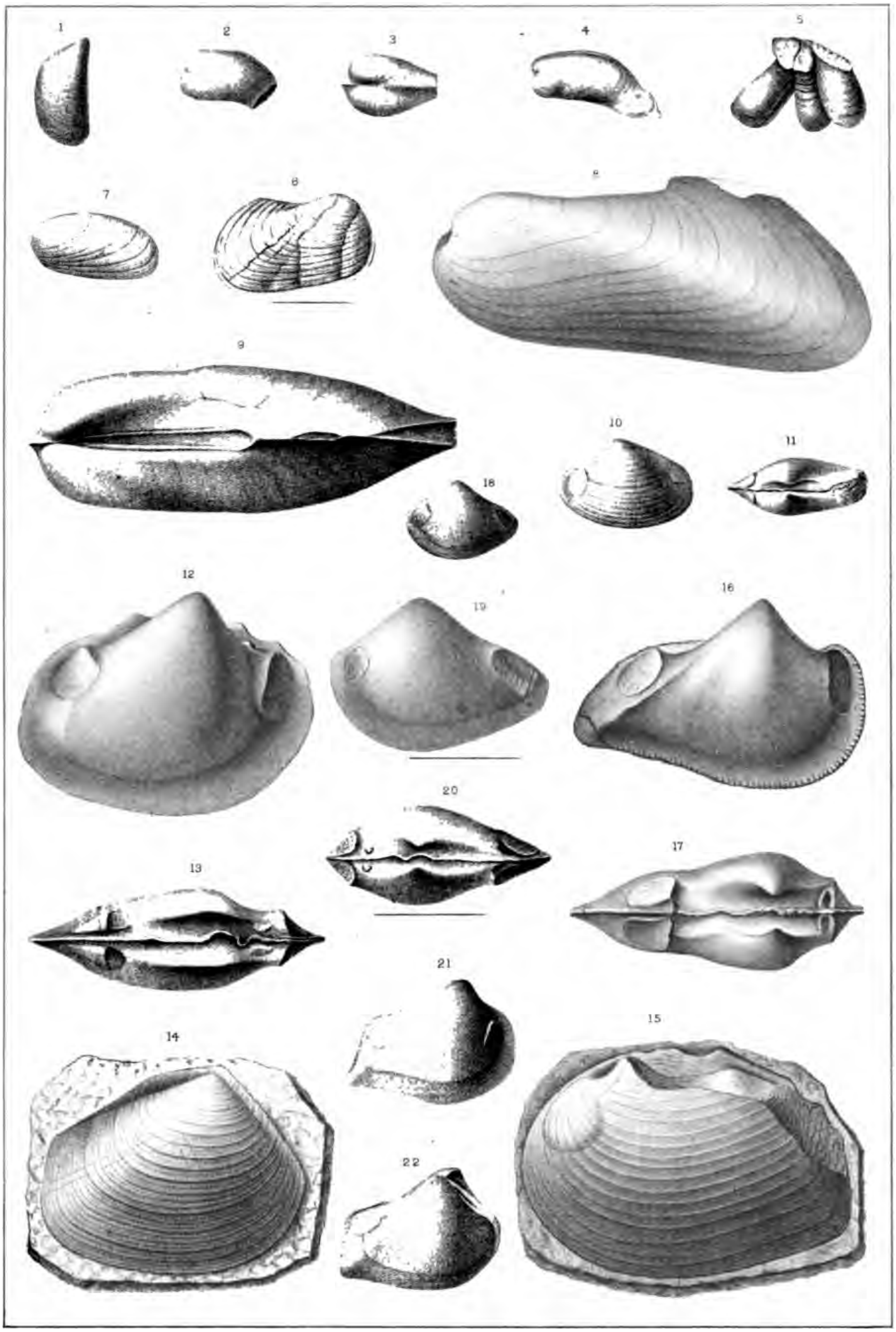

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PLATE XVIII.

Page.

Gouldia Conradi Whitfield 125

Fig. 1. Exterior of a left valve, enlarged three diameters.
2. Interior of same.
3. Interior of a right valve, enlarged to the same extent.

Gouldia decemnaria Conrad 124

Fig. 4. View of the type specimen, greatly enlarged.

Vetocardia crenulirata Conrad 128

Fig. 5. Enlarged exterior view of one of the types.
6. Interior view of same.
7. Enlarged view of the hinge of a left valve.

Scambula perplana Conrad 123

Fig. 8. Exterior of one of the types.
9. Enlarged view of a right valve (two diameters).
10. Similar view of a left valve.

Gouldia declivis Conrad 126

Fig. 11. An enlarged copy of Mr. Conrad's figure of this shell.

Gouldia paralis Conrad 126

Fig. 12. Copy of Mr. Conrad's figure cited under the description.
13. View of a fragment of what is supposed to be the shell, as obtained by a gutta-percha impression from a mold in marl from Mr. Schanck's pits near Marlborough, N. J.

Crassatella subplana Conrad 121

Fig. 14. Exterior of an imperfect specimen, which shows the general form and surface markings.
15. Interior of another specimen.
16. An imperfect cast of the species.

Dosinia erecta Whitfield 162

Fig. 17. Lateral view of a small specimen, preserving the shell.
18. Lateral view of a cast which shows the depth of the inflected cardinal border.
19. Profile view of same, showing the inflected border.
20. Lateral view of a large specimen, imperfect at the beak, but retaining the shell in part.

Lucina Smockana Whitfield 130

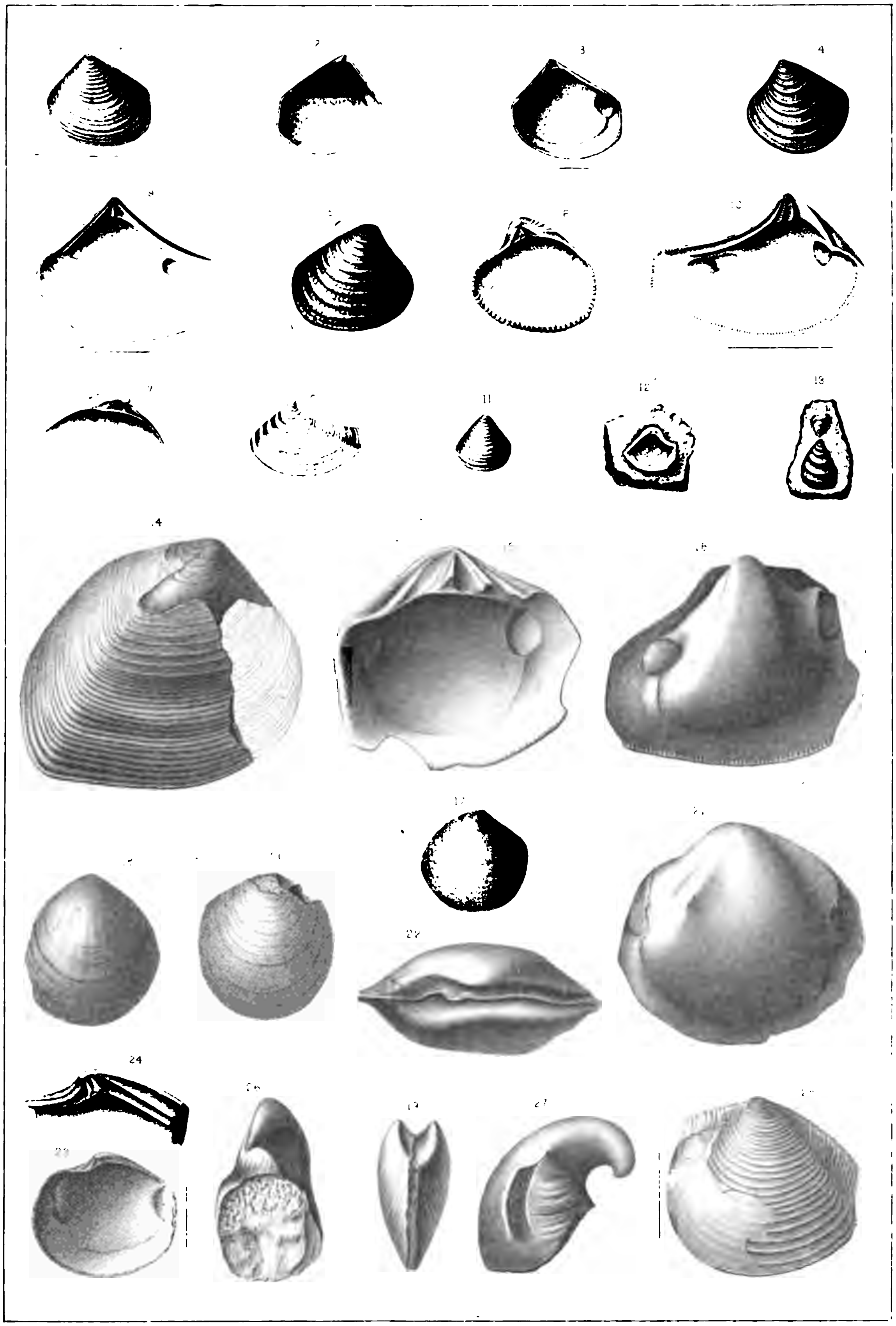
Fig. 21. Left view of an internal cast, showing the form and gibbosity of the valves.
22. Cardinal view of same.

Lucina cretacea Conrad 129

Fig. 23. View of the interior of a right valve, enlarged.
24. The hinge still further enlarged.
25. Exterior of a larger shell (two diameters).

Diceras dactyloides Whitfield 131

Fig. 26. View of the cast described.
27. Lateral view of the same, showing the muscular scar.



LAMELLIBRANCHIATA

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PLATE XIX.

Page

VENIELLA SUBOVALIS Conrad 150

Fig. 1. View of the right side of the cast, which had been labeled by Mr. Conrad.
2. View of the hinge, as obtained by a gutta-percha impression on the cast.

VENIELLA TRAPEZOIDEA Conrad 151

Fig. 3. View of the right side of a specimen, which is slightly distorted by compression.

VENIELLA INFLATA Conrad 147

Fig. 4. View of the left side of the type specimen, natural size.
5. Enlarged cardinal view of the same.

VENIELLA ELEVATA Conrad 148

Fig. 6. Vertical view of the type specimen, enlarged to two diameters.
7. Profile view of same.

VENIELLA CONRADI Morton 144

Fig. 8. View of a cast of this species, natural size, from Holmdel, N. J.
9. Similar view of another cast.
10. View of the interior of a specimen from Eufaula, Ala., of which the exterior corresponds to Fig. 9 in its varices.

VENIELLA TRIGONA Gabb 149

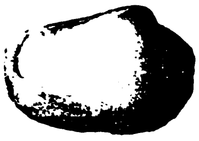
Fig. 11. View of the left side of the type specimen.
12. Anterior view, showing the convexity. The figure is very imperfect.
13. Left view of a second example, also from the collection of the Academy of Natural Sciences, Philadelphia.
14. Anterior view of the same.

VENIELLA ? DECISA Morton 145

Fig. 15. Left view of a nearly perfect cast of the species, showing the general features.
16. Anterior view of the same.

SPHÆRIOLA UMBONATA Whitfield 152

Fig. 17. Right view of the type specimen.
18. Cardinal view of the same. These figures show the ligament and general form of the shell.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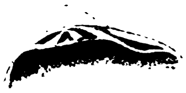
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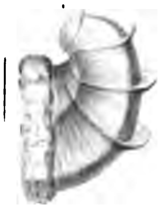
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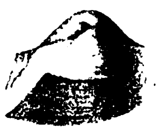
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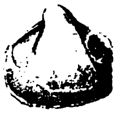
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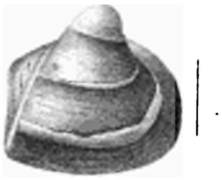
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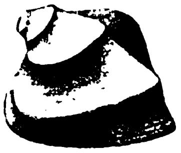
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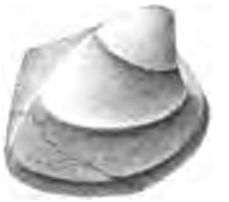
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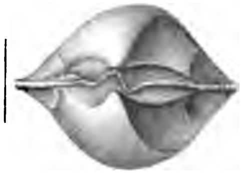
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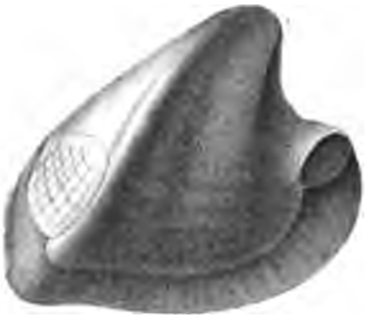
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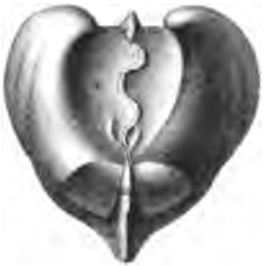
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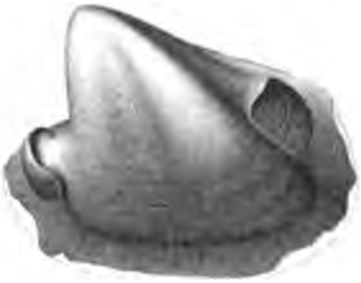
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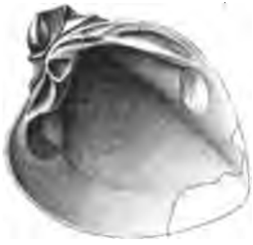
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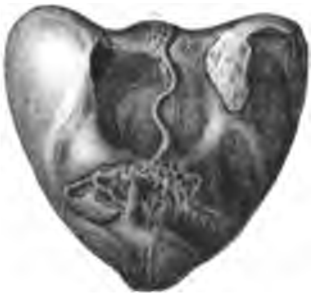
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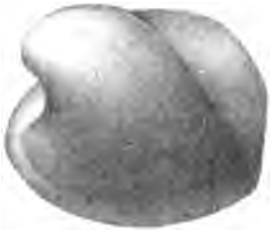
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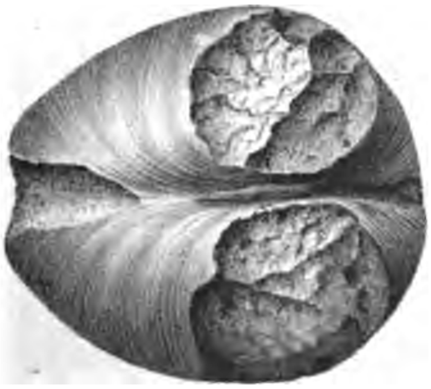
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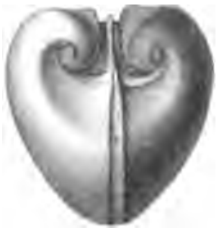
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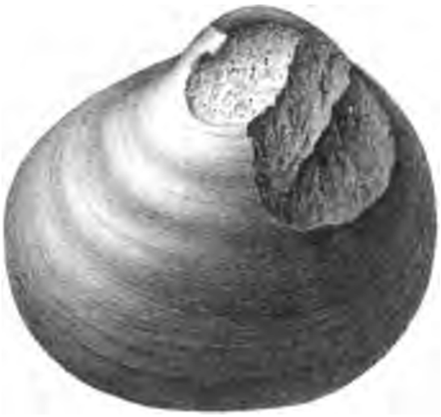
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LAMELLIBRANCHIATA.

(CRETACEOUS – LOWER MARL BEDS.)

PLATE XX.

Page

LEIOPISTHA PROTEXTA Conrad 140

Fig. 1. Lateral view of a cast of the ordinary form, from Holmdel, N. J.
2. Cardinal view of the same.
3. A cast showing finer and more numerous plications.

LEIOPISTHA INFLATA Whitfield 142

Fig. 4. View of a cast, showing the shorter, broader, and more inflated form, and the round ribs.
5. Cardinal view of the same.

CYMELLA MEEKI Whitfield 142

Fig. 6. View of a small, imperfect cast.
7. View of a larger cast, retaining both valves.

FULVIA TENUIS Whitfield 139

Fig. 8. View of the specimen described, natural size.

CARDIUM (CRIOCARDIUM) DUMOSUM Conrad 133

Fig. 9. View of a medium-sized specimen, retaining the shell in part (collection of the Academy of Natural Sciences), Haddonfield, N. J.
10 and 11. Views of a larger cast, showing the general form.
12. Enlargement of the surface, as obtained by gutta-percha pressed into a fragment of the matrix.
13. View of a small shell, with imperfect surface, found labeled *C. Alabamiensis* by Mr. Gabb (collection of the Academy of Natural Sciences).

CARDIUM RIPLEYANUM Conrad 132

Fig. 14. View of specimen from the iron-stone nodules at Keyport, N. J., enlarged four diameters.

CARDIUM (FRAGUM) TENUISTRIATUM Whitfield 139

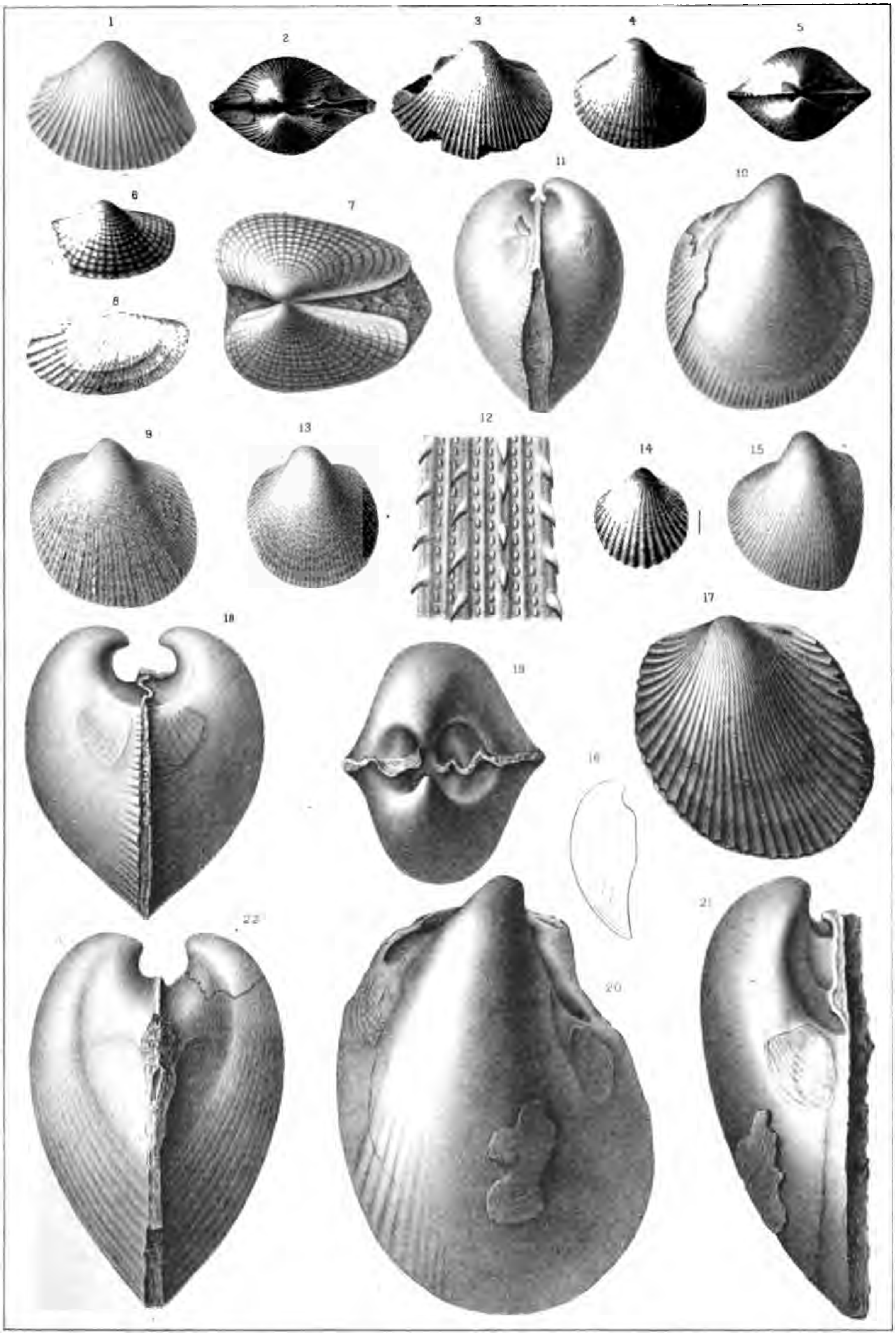
Fig. 15. View of a partial cast of a left valve.
16. An outline showing convexity of the same.

CARDIUM EUFAULENSE Conrad 132

Fig. 17. View of a cast of a left valve, where the ribs are preserved in all their sharpness. Holmdel, N. J.
18 and 19. Views of a large cast, nearly destitute of surface markings, but showing them near the front margin. The specimen has been laterally compressed.

CARDIUM (PROTOCARDIUM) PERELONGATUM Whitfield 136

Figs. 20 and 21. Views of a cast of a single valve, from Cream Ridge, N. J.
22. Posterior profile view of a cast, showing the ribs of this part



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LAMELLIBRANCHIATA.

(CRETACEOUS - LOWER MARL BEDS)

PLATE XXI.

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Cardium (Criocardium) multiradiatum Gabb 135

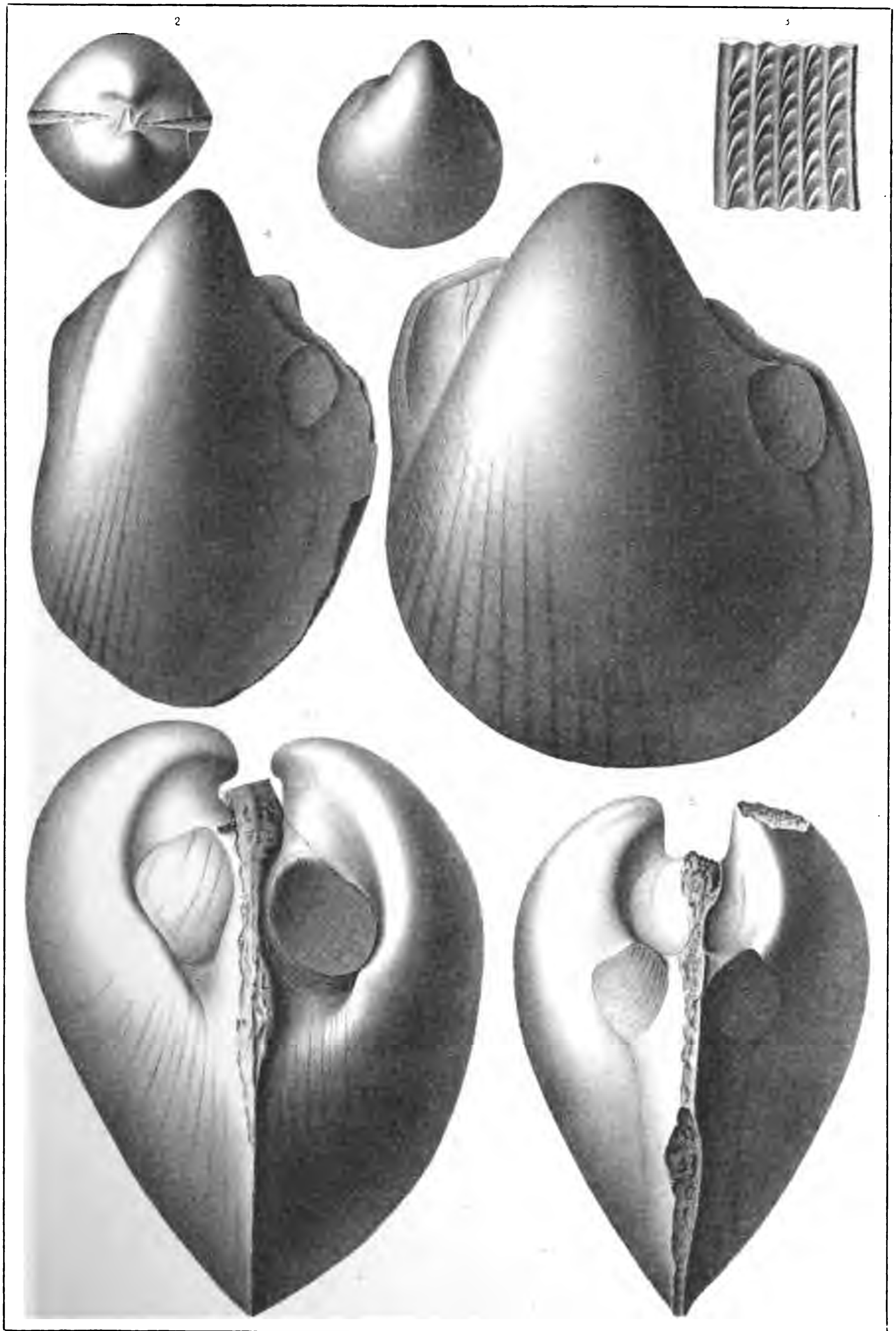
Fig. 1. Lateral view of a well-preserved cast of this species.
2. Cardinal view of the same.
3. Enlargement of a fragment of the matrix, showing the character of ribs and the spines which rise from the depressions between them, as obtained from a gutta-percha impression.

Cardium (Protocardium) perelongatum Whitfield 136

Figs. 4 and 5. Views of a large cast from the collection of the Academy of Natural Sciences of Philadelphia, showing the general form.

Pachycardium Burlingtonense Whitfield 138

Figs. 6 and 7. Views of the cast described, showing the remains of the strong, heavy ribs, and the large muscular scars.



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LAMELLIBRANCHIATA.

(CRETACEOUS: LOWER MARL BED.)

PLATE XXII.

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Tenea pinguis Conrad 163

Fig. 1. Left view of an internal cast.
2. Cardinal view of the same.
3. View of the hinge, enlarged twice, from Mr. Conrad's type, Haddonfield, N. J.

Dosinia Gabbi Whitfield 161

Fig. 4. Left view of a cast, showing all the features recognized.
5. Cardinal view of the same.

Aphrodina Tippana Conrad 154

Fig. 6. Cast of a large right valve. Deep cut, Holmdel and Keyport Turnpike.
7. A smaller left valve from Marlborough, N. J.

Callista Delawarensis Gabb 153

Figs. 8 and 9. Views of what is supposed to be Mr. Gabb's type of the species.
10. View of a young specimen, retaining the shell, from nodule in Lower Marls at Holmdel.

Cyprimeria depressa Conrad 156

Fig. 11. Interior of a shell from Haddonfield. One of Conrad's originals.
12. Exterior of the same.
13. View of a cast from Freehold; a shorter form.

Cyprimeria Heilprini Whitfield 160

Figs. 14 and 15. Views of the type specimens. Collection of Academy of Natural Sciences.

Cyprimeria excavata Morton 159

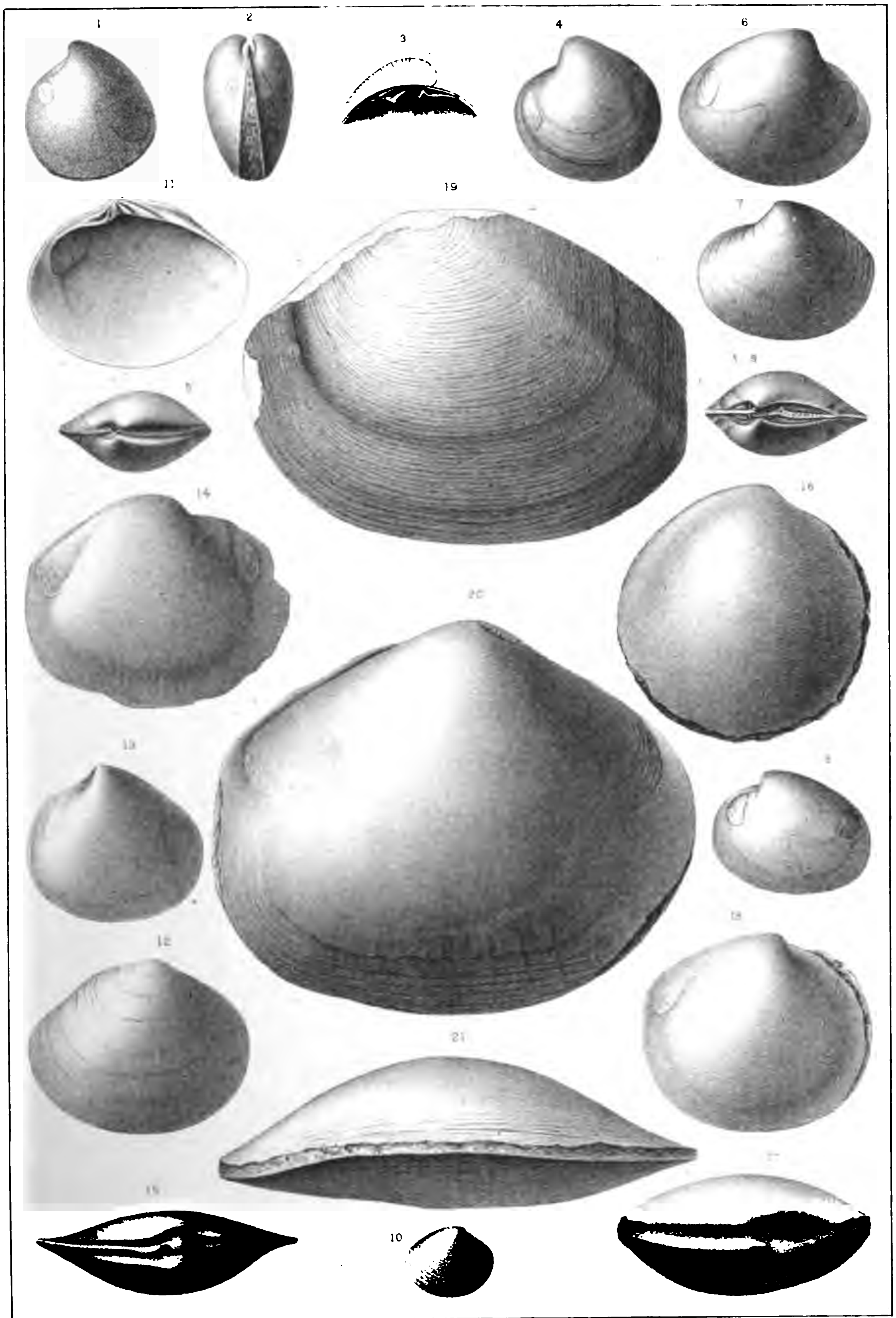
Figs. 16 and 17. Views of a very imperfect cast referred to this species. Freehold, N. J.

Cyprimeria spissa Conrad 160

Fig. 18. View of a cast of a right valve referred to this species.

Cyprimeria densata Conrad 157

Fig. 19. View of a specimen from Freehold, N. J., retaining the shell in part.
20 and 21. Views of Mr. Conrad's type specimen.



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LAMELLIBRANCHIATA.

(CRETACEOUS — LOWER MARL BEDS.)

PLATE XXIII.

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DONAX FORDI Lea 171

Fig. 1. View of the type ? specimen in the collection of the Academy of Natural Sciences of Philadelphia.

ÆNONA EUFAULENSIS Conrad 168

Fig. 2. View of the type; natural size.
3. Enlargement of the hinge to three diameters.

ÆNONA PAPYRIA Conrad 169

Fig. 4. View of the only specimen known; Conrad's type.

LINEARIA CONTRACTA Whitfield 167

Fig. 5. View of a specimen, natural size, as obtained by gutta-percha from a natural mould.

LINEARIA METASTRIATA Conrad 165

Fig. 6. View of the exterior of a shell from Haddonfield.
7. Similar view of a cast in a natural mould from Holmdel, N. J.
8. An enlargement to two diameters of the interior of the shell in Fig. 6, showing the hinge characters.

CORIMYA TENUIS Whitfield 170

Fig. 9. View of a cast of medium size.
10. Outline cardinal view of the same showing the inequality of the valves.
11. View of a larger cast, showing the vascular scars.

TELLIMERA EBOREA Conrad 164

Fig. 12. View of the type specimen; natural size.
13. Enlargement of the hinge.

PERIPLOMYA ELLIPTICA Gabb 177

Fig. 14. Left view of a cast of the species.
15. Cardinal view of the same.

ÆORA CRETACEA Conrad 167

Fig. 16. View of the exterior of Mr. Conrad's type specimen.
17. View of the hinge of the same.

VELEDA LINTEA Conrad 172

18. View of a large crushed specimen; natural size.
19. Enlargement of the hinge.
20. Enlargement to three diameters of a nearly perfect shell.
21. Enlargement to two diameters of a larger, partially exfoliated specimen. This and the foregoing are all from Haddonfield, N. J., and were used by Mr. Conrad.

VELEDA TRANSVERSA Whitfield 174

Fig. 22. View of a cast, showing the general form, surface striæ, and imprints of teeth. Marlborough, N. J.

VELEDA TELLINOIDES Whitfield 173

Fig. 23. View of a cast of a left valve, showing the strongly contrasting form with that of Fig. 22.

CERCOMYA PECULIARIS Conrad 178

Fig. 24. Exterior of the fragment described by Mr. Conrad.
25. View of the under surface, showing all that remains of the hinge.

CORBULA SUBCOMPRESSA Gabb 180

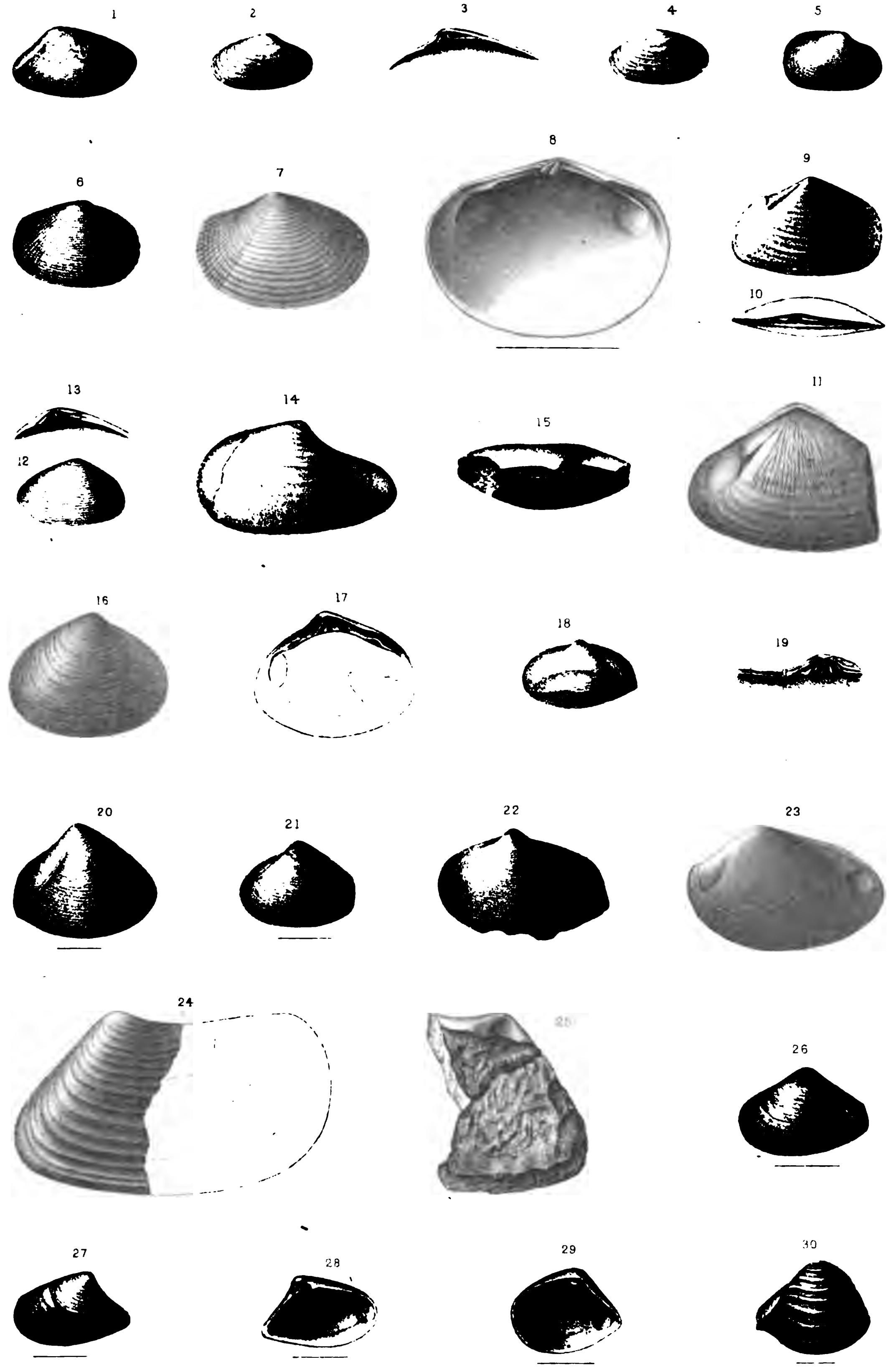
Fig. 26. View of the only specimen observed, enlarged.

CORBULA FOULKEI Lea 180

Fig. 27. Enlarged view of the exterior of a specimen from Haddonfield, N. J., the original locality.
28. Interior view of the same.
29. Enlarged view of a shorter specimen, probably a variety of the same.

CORBULA CRASSIPLICA Gabb 178

Fig. 30. Enlargement to three diameters of a specimen from Haddonfield, N. J.



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LAMELLIBRANCHIATA.

CRETACEOUS (LOWER MARL BEDS.)

PLATE XXIV.

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PHOLADOMYA OCCIDENTALIS Morton 175

Fig. 1. View of a large specimen from Monmouth, N. J., in the American Museum Natural History, New York City.

2. Anterior profile of the same.

3. Cardinal view of an imperfect specimen from Burlington, N. J.

PHOLADOMYA ROEMERI Whitfield 176

Fig. 4. View of the best preserved individual observed.

PANOPEA DECISA Conrad 181

Fig. 5. View of a cast of medium size, showing the usual form.

6. View of a larger cast from Burlington, N. J., in the collection of the American Museum of Natural History.

7. Cardinal view of a cast from Holland, Monmouth County, New Jersey.

8. View of the interior of the hinge as obtained from a gutta-percha cast from the preceding specimen.

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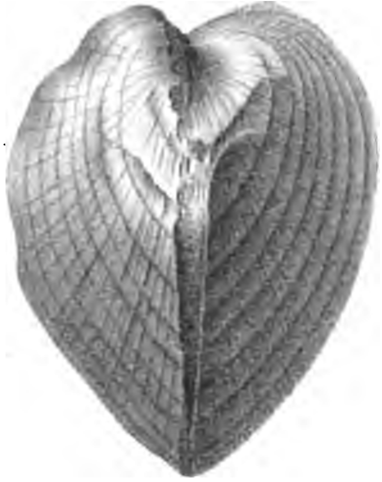

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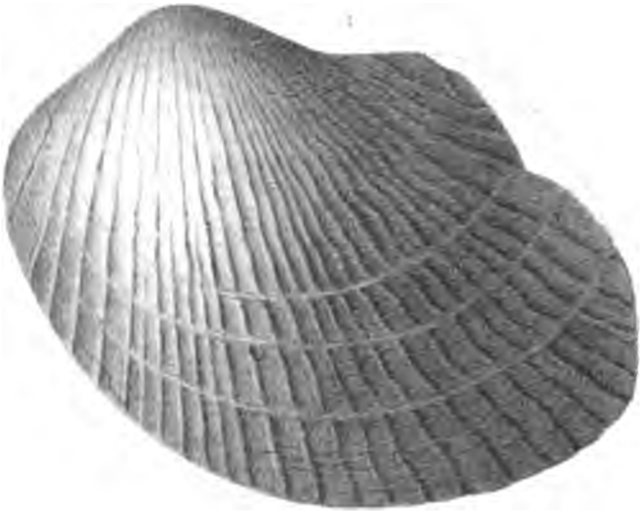

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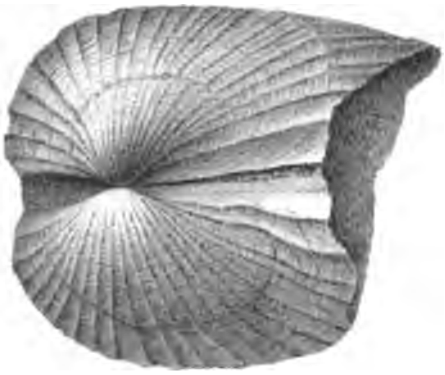

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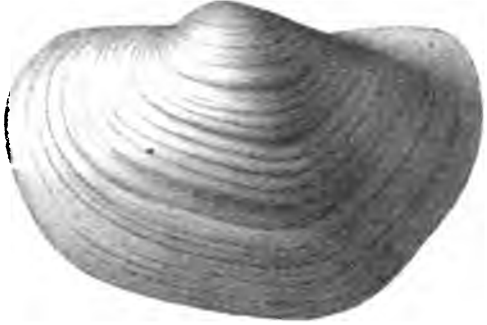

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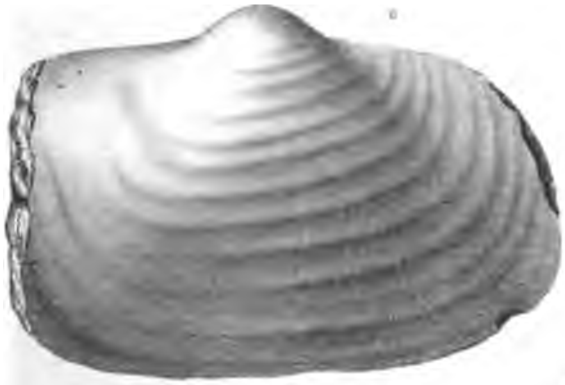

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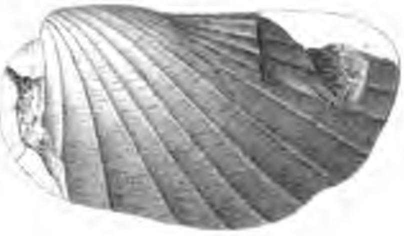

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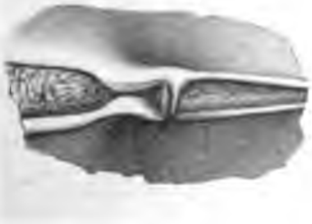

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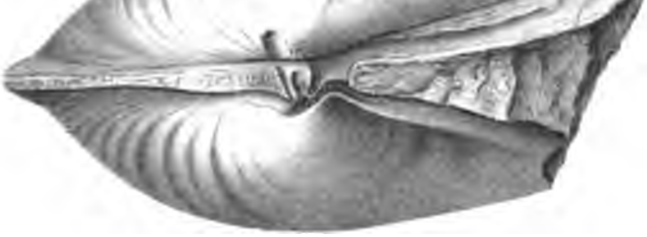

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LAMELLIBRANCHIÁTA.

(CRETACEOUS - LOWER MARL BEDS.)

PLATE XXV.

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Leptosolen biplicata Conrad 182

Fig. 1. View of the right side of the most perfect cast seen from New Jersey.
2. Cardinal view of the same.

Legumen planulatum Conrad 184

Fig. 3. View of an internal cast from Freehold, N. J.
4. A cast showing the external features of the shell, from near Marlborough, N. J.

Legumen ellipticum Conrad 184

Fig. 5. View of a shell of this species from Tippah County, Mississippi, introduced for comparison with the other species.

Legumen appressum Conrad 185

Fig. 6. View of the left side of a shell from Haddonfield, N. J.
7. Cardinal view of the same.
8. View of the hinge of the left valve, enlarged to two diameters.

Siliqua cretacea Gabb 186

Fig. 9. View of the right side of the cast used by Mr. Gabb.
10. Cardinal view of the same.

Solyma lineolata Conrad 182

Fig. 11. View of the exterior of Conrad's type specimen from Haddonfield, N. J.
12. Interior view of the same.
13. Enlargement of the hinge of the same.

Pholas cithara Morton 187

Fig. 14. Right view of the specimen described as *P. pectorosa* by Conrad. Tinton Falls.
15. Cardinal view of the same.
16. View of an imperfect specimen from near Marlborough, N. J.

Pholas? lata Whitfield 189

Fig. 17. View of the cast of a left valve, showing the features described.

Teredo irregularis Gabb 191

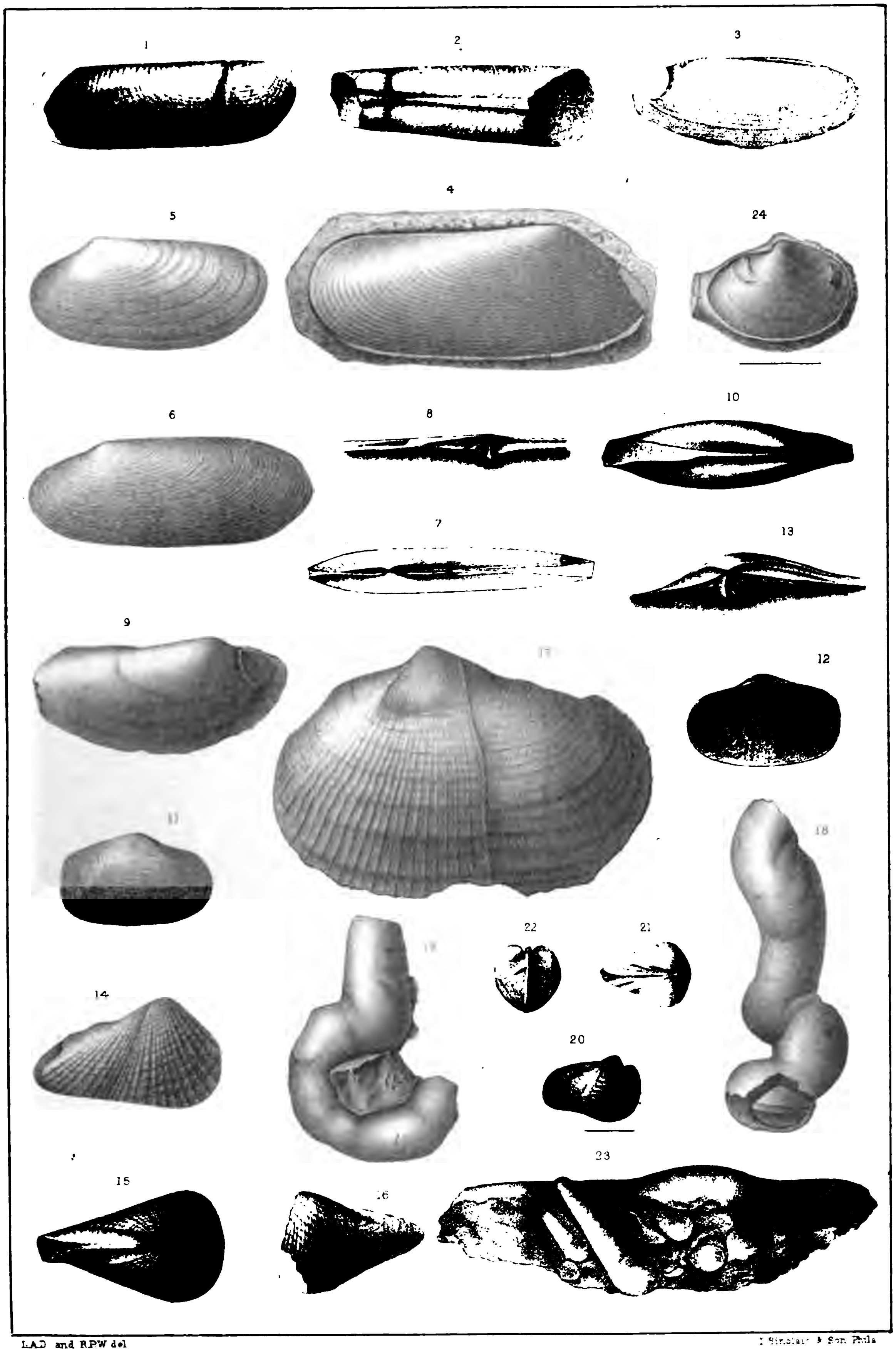
Fig. 18. View of Mr. Gabb's type specimen, showing a fragment of the cast of a shell at the lower end.
19. View of another tube cast, also one of Mr. Gabb's specimens.

Martesia cretacea Gabb 190

Figs. 20-22. Three views of an internal cast, enlarged to two diameters, showing the surface marking to some degree.
23. View of a colony of tubes, natural size, apparently the ones originally described.

Clavagella armata Morton 192

Fig. 24. Near top of plate is an enlarged view of a cast of this species, showing the general features; two diameters.



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LAMELLIBRANCHIATA.
(CRETACEOUS - LOWER MARL BEDS)

PLATE XXVI.

Page

Modiola inflata Whitfield 197

Fig. 1. Enlarged lateral view of the specimen described.
2. Cardinal view of the same.

Isocardia Conradi Gabb 200

Fig. 3. Lateral view of Gabb's type specimen.
4. Anterior view of the same, copied from Gabb's figures.

Idonearca medians Whitfield 199

Fig. 5. Lateral view of one of the examples used in description.
6. Cardinal view of the same.

Gryphæa Bryani var. precedens Whitfield 194

Fig. 7. Lower valve of a form which is very prevalent at New Egypt and in Monmouth County.
8. Upper view of the same.

Gryphæa vesicularis Lamarck 194

Figs. 9 and 10. Views of a form which is most abundant and quite characteristic of the Yellow Limestones. New Egypt.

Gryphæostrea vomer Morton 195

Figs. 11 and 12. Views of the prevalent form in the Yellow Limestones, at Timber Creek and New Egypt, N. J.

Modiola ovata Gabb 197

Fig. 13. View of the right side of Mr. Gabb's type specimen.
14. View of the anterior end of another specimen, preserving the form of the beaks more perfectly.

Idonearca compressirostra Whitfield 199

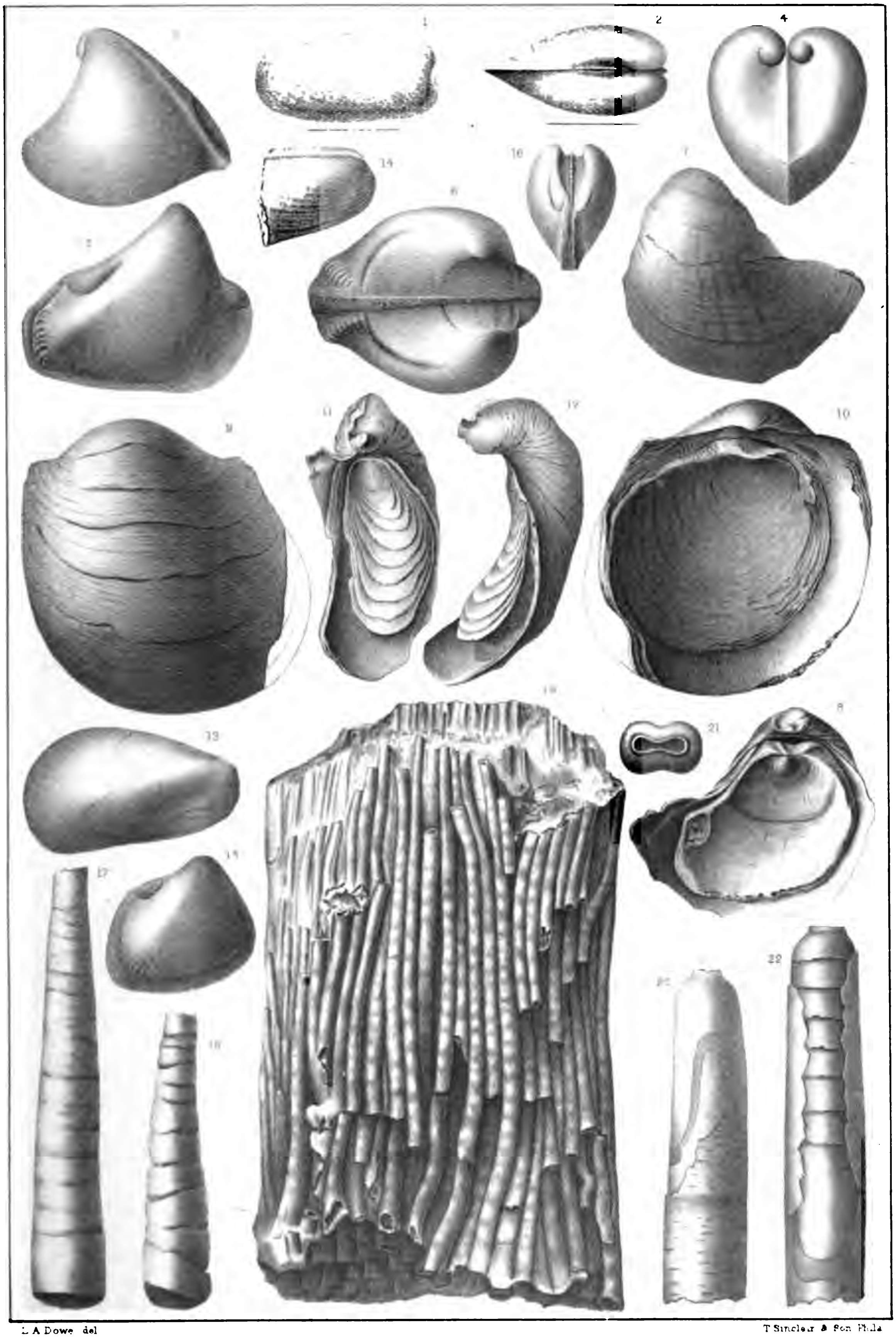
Fig. 15. Right view of a very entire specimen.
16. Anterior profile view of same.

Gastrochæna Americana Gabb 203

Fig. 17. View of cast of this species, showing the irregular constrictions of the tube.
18. A similar view of another cast.

Teredo tibialis Morton 201

Fig. 19. View of a part of a group of the tube casts, showing their usual form. Nearly all of these have been broken off at the lower end.
20. Enlargement of the upper end of a cast, showing the muscular scar.
21. Enlarged view of the aperture.
22. Enlarged view of the upper end of a tube, showing the partial septa of this part of the tube. This and the two preceding figures are copied from Mr. Gabb's figures, but have all been verified in many individuals.



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LAMELLIBRANCHIATA.
(CRETACEOUS - MIDDLE BEDS)

PLATE XXVII.

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OSTREA GLANDIFORMIS Whitfield 205

Fig. 1. Exterior view of an upper valve from Farmingdale, N. J.
2. Interior view of the same.
3. View of a lower valve from near Vincentown.
4. and 5. Views of a cast from near Farmingdale.

GRYPHÆ BRYANI Gabb 206

Fig. 6. View of a small shell, which shows the scar of attachment at the beak.
7. Interior of an older specimen.
8 and 9. Views of an old specimen, all from Mr. Gabb's type series.

ARCA QUINDECIMRADIATA Gabb 208

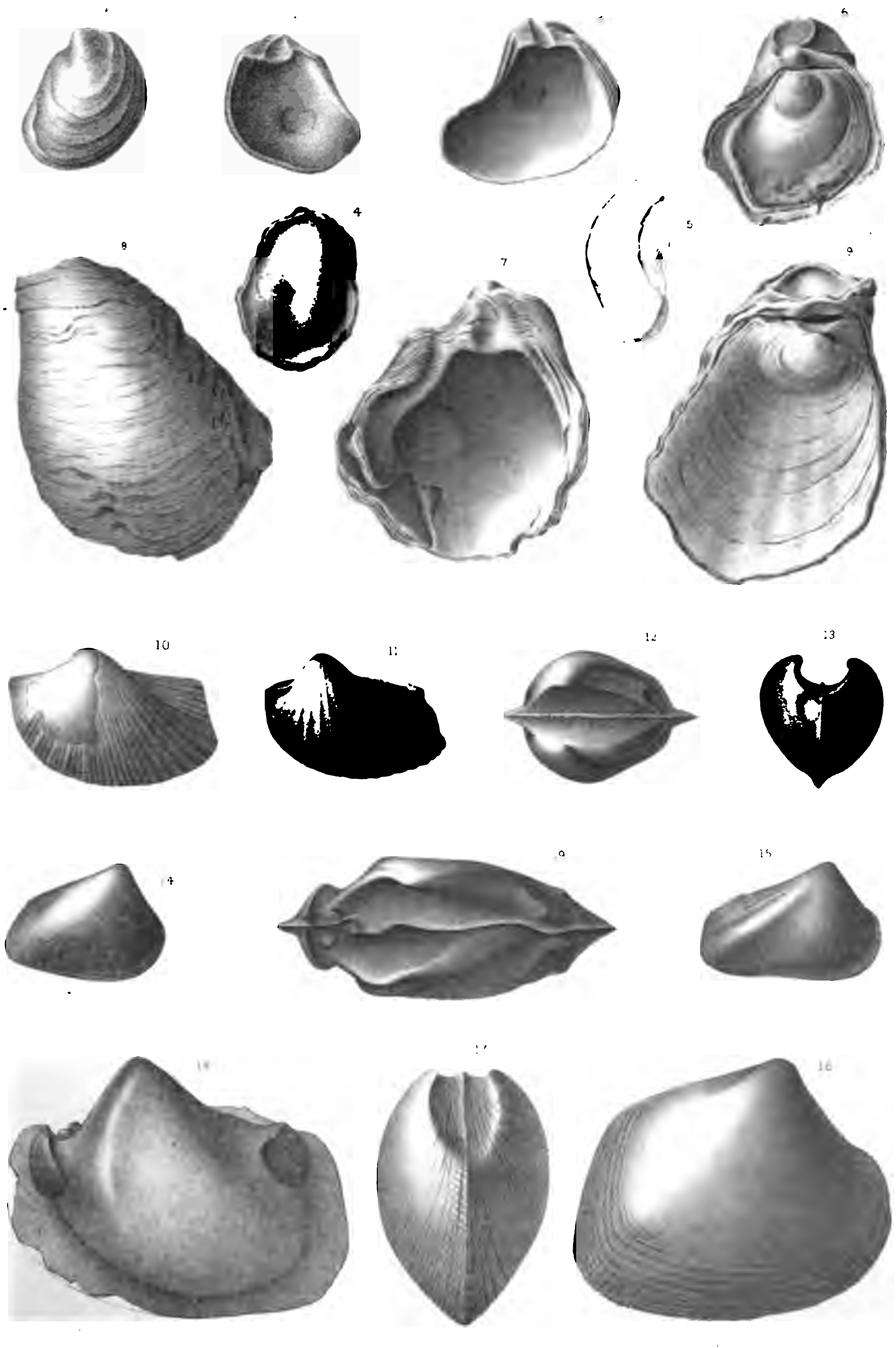
Figs. 10. Left view of a large shell preserving the surface to some extent, New Egypt, N. Y.
11–13. Views of an internal cast, showing the usual features of the species, New Egypt, N. J.

CRASSATELLA DELAWARENSIS Gabb 210

Fig. 14. View of a small specimen from near New Egypt, preserving the shell.
15. View of a cast, the usual condition, from near Farmingdale, N. J.

CRASSATELLA RHOMBEA Whitfield 213

Fig. 16. Right view of a specimen preserving the shell, the only one ever found, near New Egypt, N. J.
17. Anterior profile view of the same.
18. Left view of an internal cast from Squankum, N. J. Columbia College.
19. Cardinal view of the same.



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LAMELLIBRANCHIATA.

(CRETACEOUS – BASE OF UPPER MARL BEDS)

PLATE XXVIII.

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Crassatella curta Conrad ? 209

Figs. 1 and 2. Views of a cast from Squankum, N. J. Columbia College collection.
3. A partial cast from New Egypt, showing surface striæ. A. M. N. H. collection.
4 and 5. Views of a similar specimen from Squankum. Rutgers College collection.

Crassatella littoralis Conrad 212

Fig. 6. An imperfect shell of the species from Squankum. Rutgers College collection.
7. View of an internal cast showing its elliptical form and rounded umbonal ridge, Squankum. Columbia College collection.

Modiola Johnsoni Whitfield 207

Fig. 8. Cardinal view, natural size, of a very perfect specimen of the species.
9. Lateral view of the same.

Criocardium nucleolus Whitfield 214

Fig. 10. Lateral view, enlarged, of an internal cast of the usual size and form.
11. Cardinal view of the same.

Veniella rhomboidea Conrad 215

Fig. 12. Lateral view of a shell presenting the usual features.
13. Cardinal view of the same.

Cardita intermedia Whitfield 209

Fig. 14. Lateral view of an internal cast, showing the remains of plications on the margin.
15. Cardinal view of the same.

Caryatis veta Whitfield 218

Fig. 16. View of a cast from Squankum, N. J.
17. View of a cast from Farmingdale, N. J.
Fig. 18. Lateral view of a specimen from Farmingdale, N. J., preserving the shell and showing the surface striæ.
19. Anterior view of the same.

Periplomya truncata Whitfield 220

Fig. 20. Lateral view of a cast from near New Egypt, N. J. Rutgers College collection.
21. Cardinal view of the same.

Petricola Nova-Ægyptica Whitfield 216

Fig. 22. View of the specimen described showing the form of the shell and the pallial sinus.

Veleda nasuta Whitfield 217

Fig. 23. View of a right valve showing the surface striæ.

Panopea elliptica Whitfield 219

Fig. 24. Lateral view of the most perfect specimen observed.
25. Cardinal view of the same.

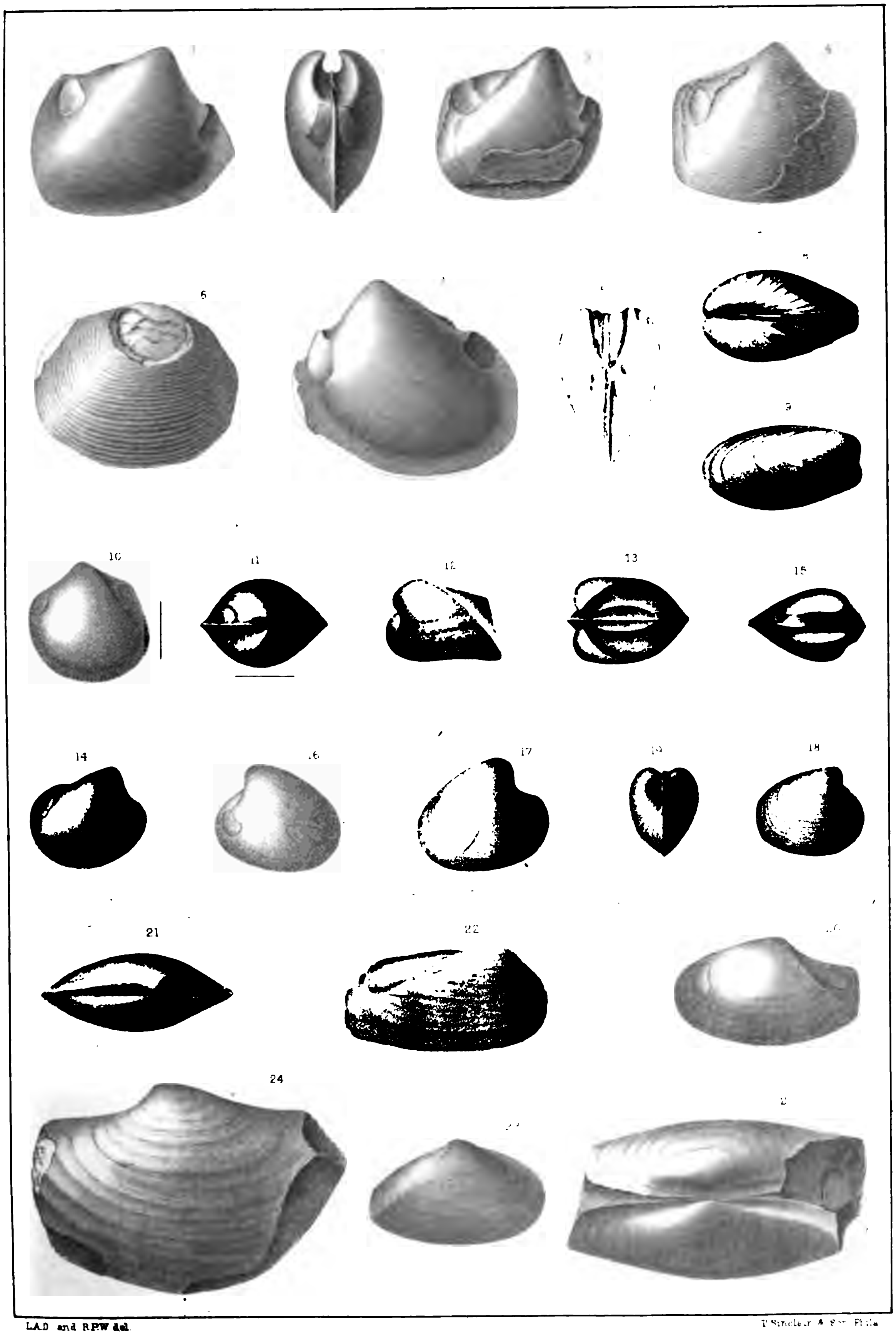

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PLATE XXIX.

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OSTREA LINGUAFELIS Whitfield 223

Fig. 1. View of the cast described.

OSTREA GLAUCONOIDES Whitfield 222

Fig. 2. View of a cast of a lower valve.

PECTEN KNEISKERNI Conrad 224

Fig. 3. View of the type specimen as obtained by a gutta-percha cast in the natural mold.
Fig. 4. View of an internal cast of a left valve showing the radii flattened and indistinct.
Fig. 5. View of the exterior of a right valve as obtained from the natural mold.

PECTEN RIGBYI Whitfield 226

Fig. 6. Enlarged view of the type, a right valve, obtained from the natural mold.

GRYPHÆA VESICULARIS Lamarck 224

Fig. 7. Vertical view of the cast described.
8. Lateral view of the same.

AVICULA ANNOSA Conrad 226

Fig. 9. If the figure be turned so as to bring the point at the right end downward, its resemblance to a fragment of a univalve shell will be readily seen.

AXINEA CONRADI Whitfield 230

Fig. 10. Upper view of the cast described.
11. Outline profile of the same.

NUCULA CIRCE Whitfield 227

Fig. 12. View of the cast of a left valve, natural size.

NUCULARIA SECUNDA Whitfield 229

Fig. 13. View of a right valve, natural size.
14. Enlarged view of the same.

NUCULANA ALBARIA Conrad 228

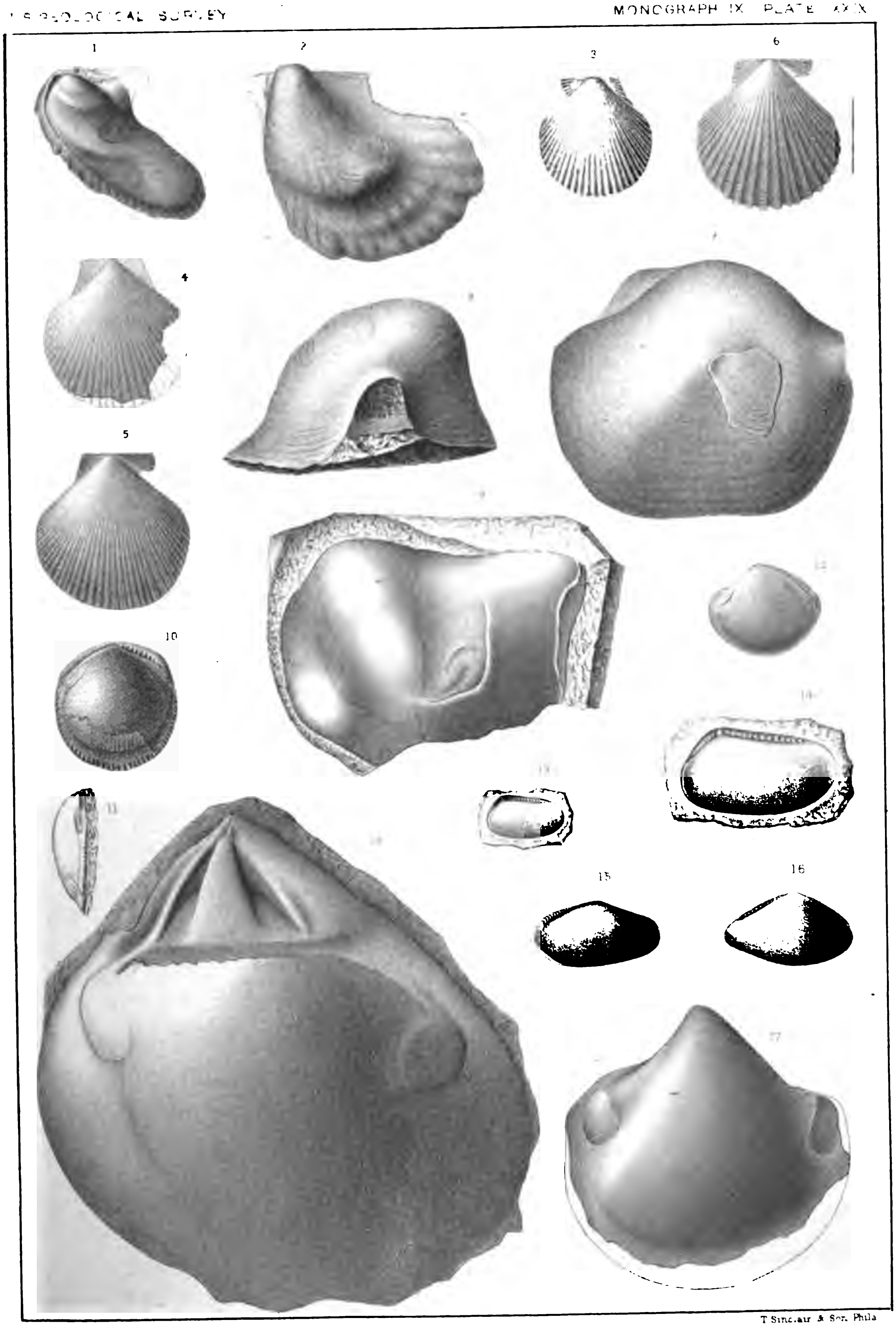
Figs. 15 and 16. Views of two specimens showing the extremes in form.

CRASSATELLA ALTA Conrad 234

Fig. 17. View of an imperfect cast which is referred to this species.

CRASSATELLA OBLIQUATA Whitfield 235

Fig. 18. View of an internal cast of a left valve showing the massive hinge plate and teeth.



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(EOCENE—UPPER LAYER OF UPPER MARLS)

PLATE XXX.

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ASTARTE CASTANELLA Whitfield 231

Fig. 1. View of cast of the right valve, showing the crenulations of the border.
2. Similar view of a left valve.

ASTARTE PLANIMARGINATA Whitfield 232

Fig. 3. View of a cast of a left valve. Natural size.
4. Enlarged view of a rounder specimen

PROTOCARDIA CURTA Conrad 236

Fig. 5. Cast of a right valve which retains the fine radiating striæ.
6. View of a specimen retaining both valves.
7. View of the hinge as obtained from the specimen, fig. 6, by gutta-percha.

CARDITA PERANTIQUA Conrad 232

Fig. 8. A cast of the interior.
9. The exterior as obtained by gutta-percha from a natural mold.
10. Enlargement of four of the anterior ribs from the last figure.

CARDITA BRITTONI Whitfield 233

Figs. 11 and 12. Views of a specimen which is somewhat distorted, but shows the fine ribs.

CRASSATELLA OBLIQUATA Whitfield 235

Fig. 13. Right side view of a very perfect cast of this species.
14. Anterior profile view of same.

CARYATIS OVALIS Whitfield 237

Fig. 15. View of the cast of a right valve which shows the surface features.
16. Similar view of a left valve which retains the features of the exterior.

VELEDA ÆQUILATERA Whitfield 238

Fig. 17. Enlarged view of a cast of a left valve of this species.

CORBULA (NEÆRA) NASUTOIDES Whitfield 239

Fig. 18. View of the right side of a small rotund specimen.
19. A similar view of a larger slightly compressed specimen.

NEÆRA ÆQUIVALVIS Whitfield 240

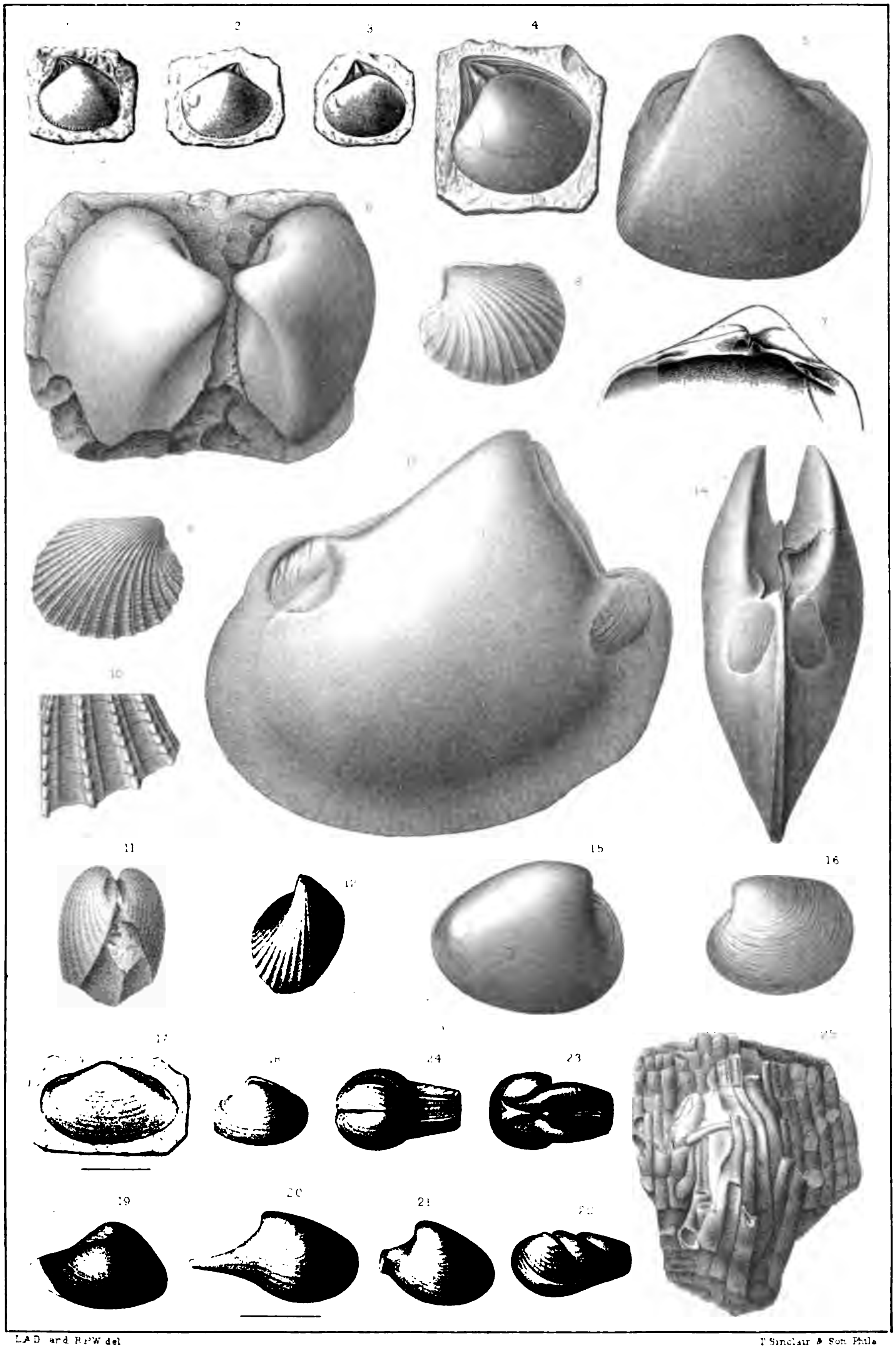
Fig. 20. Enlarged view of a specimen showing the rostrum nearly entire.
21. A larger specimen, natural size, imperfect behind.

PARAPHOLAS KNEISKERNI Whitfield 241

Fig. 22. Lateral view, natural size.
23. Cardinal view of the same specimen.
24. Basal view of the same.

TEREDO EMACERATA Whitfield 242

Fig. 25. View of a group of the fillings of tubes showing their general character.



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(EOCENE - UPPER LAYER OF UPPER MARLS)

PLATE XXXI.

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UNIO LIGAMENTINOIDES Lea	249
Fig. 1. View of the right side of Mr. Lea's type of the species.	
UNIO PRÆANODONTOIDES Whitfield	250
Fig. 2. View of the type specimen.	
UNIO ROANOKOIDES Lea	248
Fig. 3. Outline cardinal view of a large specimen of the species.	
UNIO HUMEROSOIDES Lea	248
Fig. 4. View of the right side of Lea's type specimen.	

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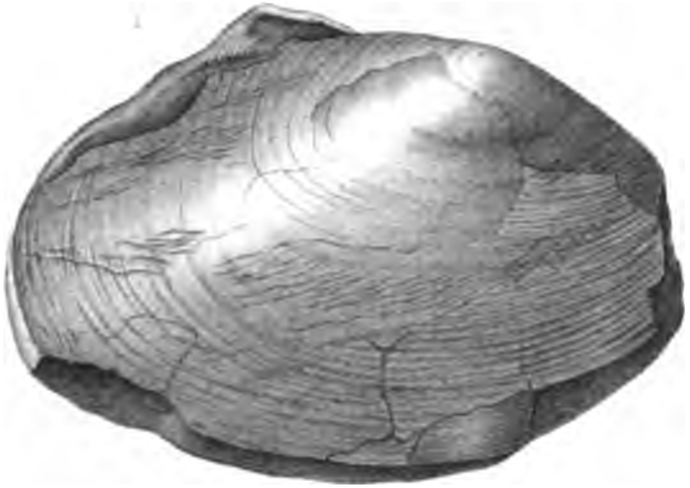

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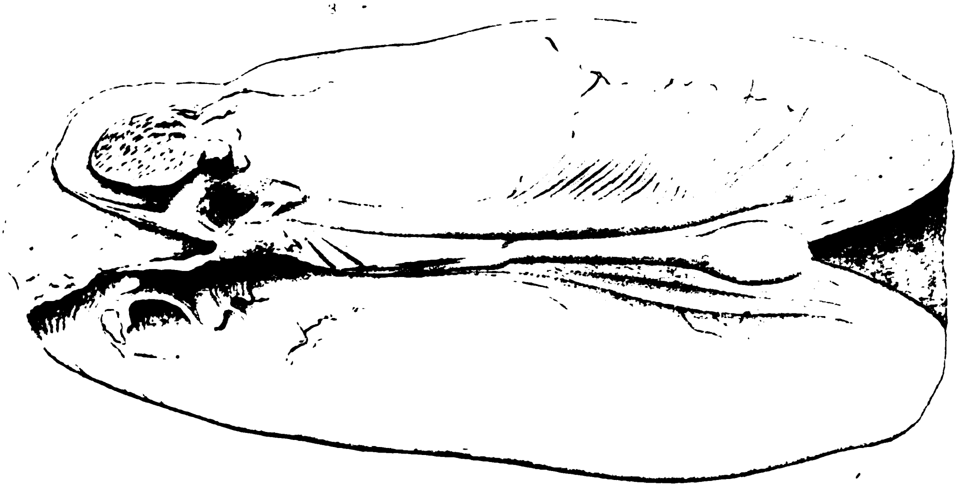

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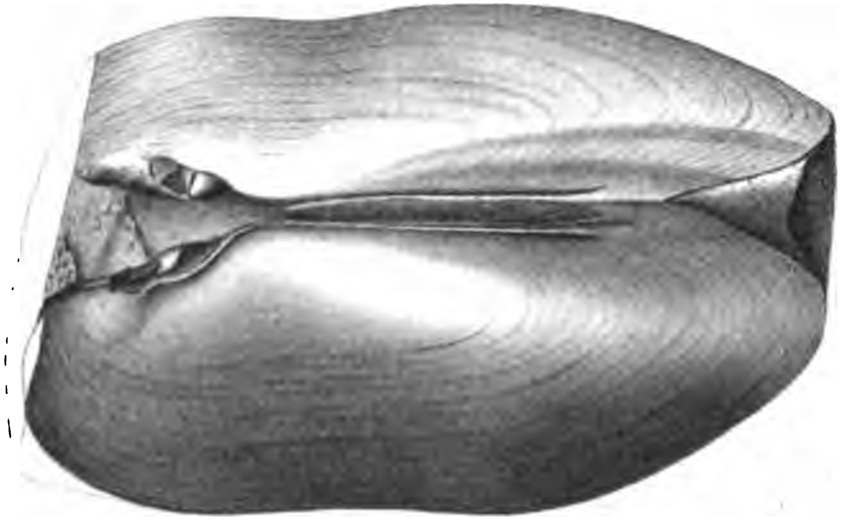

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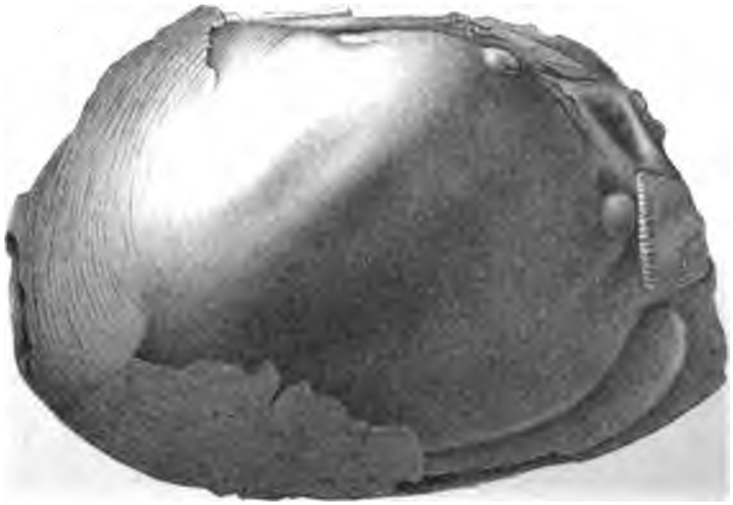

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LAMELLIBRANCHIATA
(CRETACEOUS UNIONIDAE.)

PLATE XXXII.

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Unio rectoides Whitfield 250

Fig. 1. Cardinal view of the type.

2. Right side of the type.

Unio cariosoides Lea 247

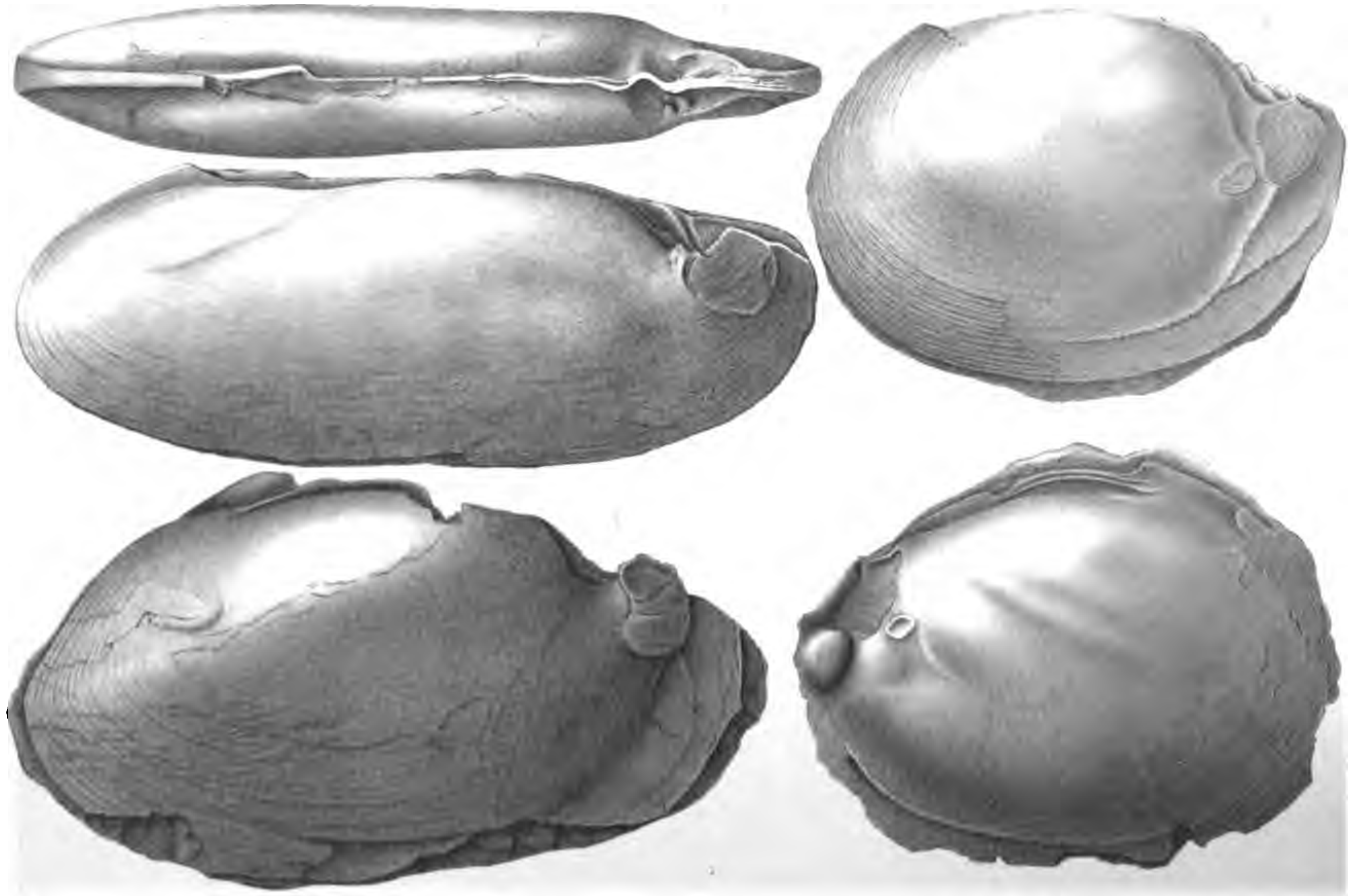
Fig. 3. View of the right side of the type specimen.

Unio ligamentinoides Lea 249

Fig. 4. Right side of a specimen identified with this species. For figure of Mr. Lea's type see Plate XXXI, Fig. 1.

Unio subrotundoides Lea 246

Fig. 5. View of the left side of Mr. Lea's type.



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(CRETACEOUS — UNIONIDAE.)

PLATE XXXIII.

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Unio Roanokoides Lea 248

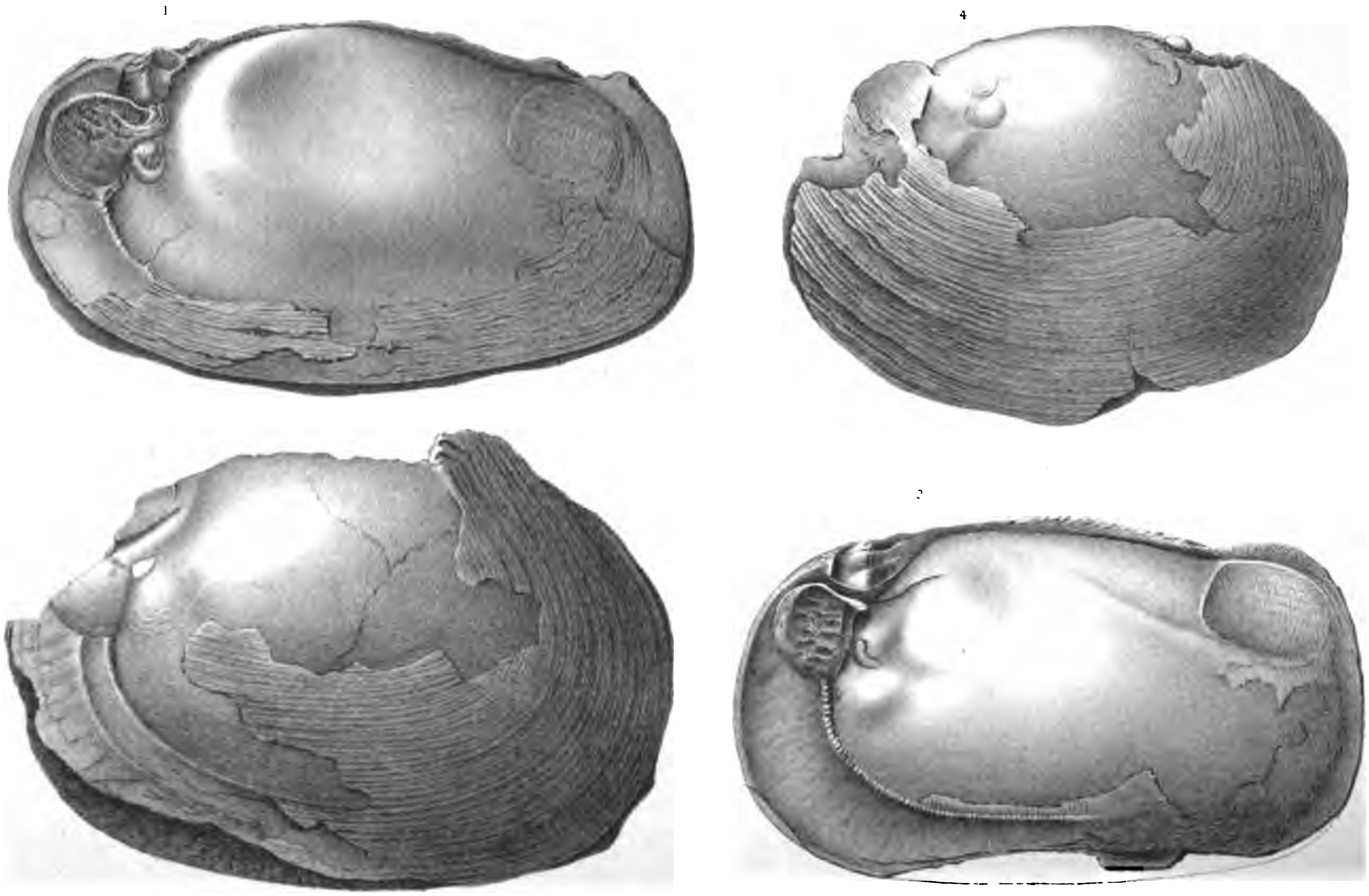
Fig. 1. Left view of a specimen of the prevailing form.

2. Left view of another specimen, showing less arcuation of the hinge-line and a more quadrangular form. See outline, Fig. 3, Plate XXXI.

Unio alatoides Lea 249

Fig. 3. View of a specimen of this species, showing a portion of the posterior alation.

4. View of another specimen differing in size and in the curvature of the basal line.



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(CRETACEOUS UNIONIDAE.)

PLATE XXXIV.

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Unio radiatoides Lea 245

Figs. 1–3. Views of three different examples of the species showing slight variations in form and condition of preservation.

Unio nasutoides Lea 244

Fig. 4. Left view of one of the best preserved individuals of this species.

5. Cardinal view of same. The valves are separated to a considerable extent along the base, giving an appearance of greater depth than it actually possesses.

Unio alatoides Lea 249

Fig. 6. Outline cardinal view of the specimen shown on Plate xxxiii, fig. 3.

Unio Roanokoides Lea 248

Fig. 7. Outline cardinal view of the specimen, Plate xxxiii, fig. 2.

Unio ligamentinoides Lea 249

Fig. 8. Outline cardinal view of the specimen, Plate xxxii, fig. 4.

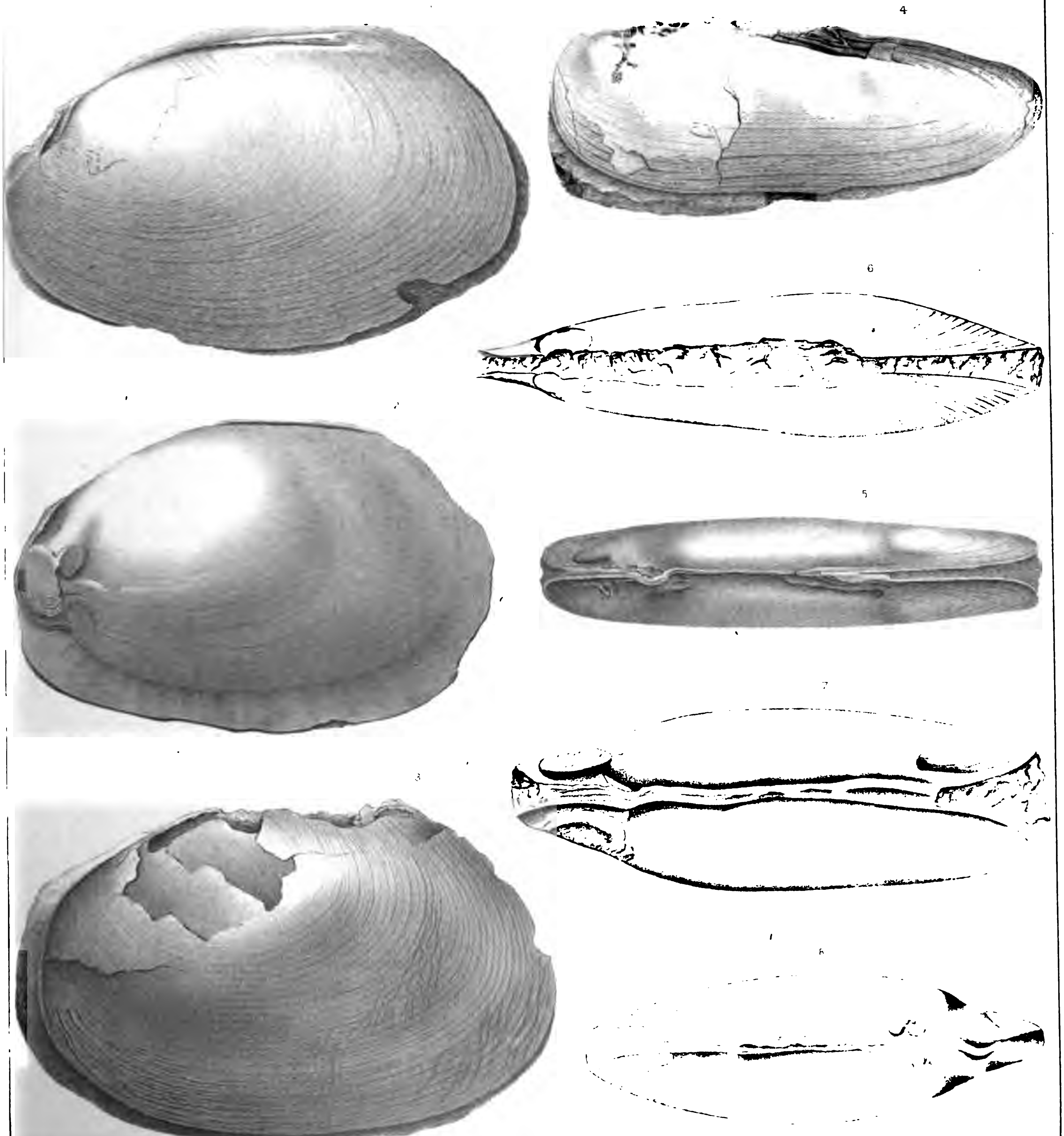

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PLATE XXXV.

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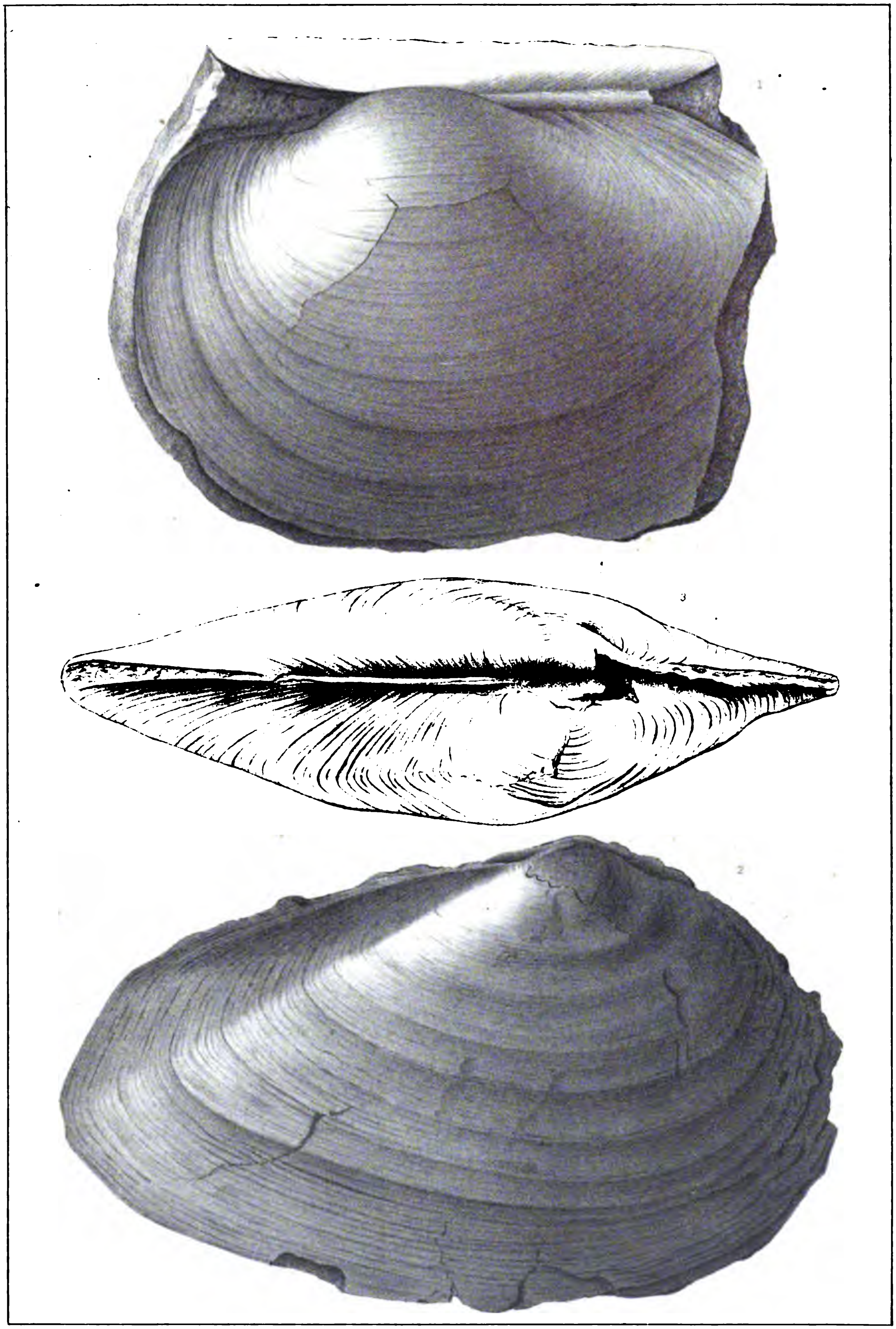
ANODONTA CORPULENTOIDES Lea	252
Fig. 1. View of the left valve of a specimen which preserves the valves spread open.	
ANODONTA GRANDOIDES Lea	251
Fig. 2. View of the right side of a very well preserved specimen of the species.	
3. Outline cardinal view of the same specimen	



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